> the windward side, the other being open. They have little areas before the most of them, 175
> which are generally planted round with trees, or shrubs of ornament, whose fragrancy 342
> perfumes the very air in which they breathe. [352]
> [351]

Again, in 1777, Cook (19, vol. 1, p. 314) describes Tongatabu, as he saw
it on "an excursion into the country," in the following words: 175
361

> We found by far the greatest part of the country cultivated, and planted with 311
> various sorts of productions; and most of these plantations were fenced around.
> Some spots, where plantations had been formerly, now produced nothing, lying fallow;
> and there were places that had never been touched, but lay in a state of nature; and,
> yet, even those were useful, in affording them timber, as they were generally covered [643]
> with trees. We met with several large uninhabited houses, which, we were told, [491]
> belonged to the king. There were many public and well-beaten roads, and abundance
> of foot-paths leading to every part of the island. [487]

The nearest approach to a village, observed by Cook was the capital Mua 175
(the modern villages of Lapaha and Tatakamotonga), where the principal 361
chiefs of Tongatabu dwelt, especially when attending the court of the
Tui Tonga.

A map of Tongatabu Island, published in 1810 by Vason (60), although 491
doubtless inaccurate as to details, shows the great road traversing the length
of Tongatabu and the numerous lanes separating the farms.

La Perouse (47, vol. 2, pp. 171, 172) describes the south coast of Tongatabu as follows: 175

> As the wind was to the north, I steered towards the south coast of the island, 175
> which is very free from danger, and may be approached within three musket-shots. 133
> The sea broke furiously all along the coast; but the breakers were upon the shore;
> and beyond them we perceived the most luxuriant orchards. All the island appeared 175
> to be cultivated; the fields, which were beautifully green, were bordered with trees 311
> . . . The huts of the islanders were not collected together in villages, but dispersed 361
> over the fields, like the farm-houses in our best cultivated plains.

In 1793 conditions seemed to be unchanged, for Labillardière (37, vol. 2, pp. 135, 136, 153) says:

> In advancing to the westward, we went over a vast enclosure formed by palisades, [417]
> the stakes of which, placed obliquely, were pretty close to each other, and in the
> middle of which grew the bread-fruit tree, the plantain-tree, the fan palm, *corypha* [245]
> *umbraculifera*, &c. Farther on, we found, within a fence not near so extensive, a [417]
> small hut, of a conical form, in which we learnt were deposited the remains of a chief [764]
> lately dead; and we were also informed that it was forbidden to enter it.
>
> We then walked, for near a quarter of an hour, along a narrow road lined with [622]
> palisades on both sides: we followed it as far as a very large lawn, where King [491]
> Toobou was shortly to make his appearance. . . .
>
> We soon after entered the fields, where we saw each individual's ground divided into small plots, surrounded by palisades, and in a high state of cultivation.

The missionaries who took up their residence in 1797 speak of certain 175
places as the residences of chiefs—for example, Haateiho and Mua (spelled 361
797

Tui Tonga tracts in the Vavau group are: Koloa Island; Vaipoa, Vavau 643
Island; Tamamualoto, Vavau Island; Vakataumai, Kapa Island; Pulinitu, 423
near Haalaufuli, Vavau Island; Hauofa, between Haakio and Lafoou, Vavau 103
Island; Lavengahau, near Ngaakau, Vavau Island.

BOUNDARIES

In Tonga trees and ancient roads commonly served as boundary marks 423
instead of stones, which are too readily moved. Land hunger is one of the [685]
failings of the Tongans and to-day, when a noble dies, his neighbors, if [768]
possible, encroach on his *tofia*, making haste to do so before his successor
is appointed and trusting that the new owner will be ignorant of the true
boundaries. Many present day nobles are averse to having their hereditary [659]
lands surveyed by the government surveyor because this would prevent
further boundary shifting.

The *ngatae* (*Erythrina indica*) seems to have been the favorite tree for 423
marking boundaries because it grows rapidly. Coconut, *koka* and *buko* 824
trees formed more permanent boundaries, usually replacing the *ngatae* when [137]
it died. I heard that the word *ngatae* is a modern rendering of *ngatahe*
which means boundary and anciently designated the tree as well. Thus
when the Tui Kanokupolu allotted a piece of land to a follower, he said
"Ngatahe," meaning that the follower should mark the boundary by planting
ngatahe trees.

ABSENCE OF TRUE COMMUNAL LANDS

Anciently there seems to have been no lands that were, strictly speaking, 423
communal. Perhaps the nearest approach to a communal tract was the [311]
malae or green in proximity to the house or houses of a chief, an enclosed
lawn which was used as a place of ceremonial meetings, dances, and entertainments,
such as boxing and wrestling. As now used, the term *malae*
applies to a chief's burial place (the common use in eastern Polynesia) and
to the lawn area adjacent to any house.

An example of modern communal tenancy was noted in Lifuka Island. 423
Although the tract (*api*) Fiehua belongs to the Queen, in 1920 it was used 311
as a communal field for the village of Pangai, each man in Pangai having
a small section in which to plant sweet potatoes. When the potatoes were [651]
harvested, a number of basketsful were presented to the queen. However,
the coconuts which grew in this field were not the property of the townspeople.
Copra was made from the nuts by the queen's caretaker, a matapule [245]
named John Tuione, who usually received half of the proceeds, some- [644]
times all.

2: Mariner F-5 (1806-1810) 1818
OU9 Tonga OU9

gination can well conceive, and constituting a 133
species of scenery, which, in proportion as it is 137
more rare, is more admired by the natives. To
this retired spot you proceed along a road 487
which runs through the whole length of the 137
plantation, till you arrive at a thick wood of 136
tamanoo and *toa* trees, situated on a very steep
descent, down which the road becomes a narrow
path, winding from side to side, and beset
on either hand with the *myíle* and *jiále*, and
other shrubs, planted by the liberal hand of nature,
whose variegated flowers perfume the air
with the most delightful aromatic fragrance;
whilst, from the lofty branches of the trees, the
ear is soothed with the soft and plaintive voice
of the wood-pigeon calling to his mate. Having 133
proceeded with slow and lingering step [245]
along this winding path, for about five hundred
yards, a flat plantation of cocoa-nut trees presents
itself, through which, at a little distance,
a beautiful prospect of the sea suddenly bursts
upon the view. On each side a steep and lofty
ridge of rocks, in the form of a crescent, extends
into the water, forming a sort of bay.
The ridge of rocks on the left hand are,
for the most part, the highest, but, at the termination
of that on the right, one, loftier than
the rest, extends upwards to a great height,
like the turret of some ancient battlement.

8: Collocott & Havea M,I-5 (no date) 1922
OU9 Tonga OU9

539 461 829 **8. Nae hanga ki fe hoo sipeiti:** Where was your spade turned, that is, what has your spade been turned towards?

This is the usual retort to one who begs that which he should have prepared for himself. It refers primarily to the produce of the garden but is used of wealth generally. The word *sipeiti* is not Tongan, but a corruption of the English "spade." Whether, before contact with Europeans, there was a similar expression with the real Tongan word for a spade or digging-stick, we are unable to say.

539 241 461 **9. Matenga i vao kaka:** Fatigue in barren soil.

The word *vao* signifies a piece of scrub land. The husbandman in preparing for his garden selects a site and clears the brush. This expression is applicable to one who undergoes the labor and fatigue of clearing and planting a piece of land that proves unfertile. It is labor in vain.

539 173 643 581 **10. Ne ongo e fena ka ko Nua:** Although she has sprouted yet *Nua.*

An early Tui Tonga sent to the chief Loau for one of his daughters. Instead of asking outright for the girl the Tui Tonga's messenger was instructed to ask Loau for yams. Possibly the messenger himself did not know the purport of his errand but Loau at once understood, probably from previous agreement between himself and the Tui Tonga. Loau had two daughters, the younger not yet of marriageable age, the other named Nua, had recently borne a child. Loau, therefore, still in the language of the yam crop, returned answer to the Tui Tonga that one part of the crop was not yet ripe, and that the other part had already sprouted, using the word *fena,* which means a piece of seed yam which has been planted and commenced to grow. The Tui Tonga replied as above, meaning of course that although Nua had borne a child to someone else yet he still wanted her, for she was a very beautiful woman.

11. Oku fena ae tau kei mula ae tau: The crop is sprouting, the crop is still unripe.

As explained in No. 10, the reference is to the answer of Loau to the Tui Tonga, who sent for one of Loau's daughters. One is over-ripe, and the other is not ripe enough.

539 245 **12. Paki moe talaha:** Pick the remainders too.

In the breadfruit tree all the fruit do not ripen together, and so in plucking the crop the ripe fruit will be taken and the others left to mature. This expression means to strip the tree bare of unripe as well as of ripe fruit.

539 244 622 **13. Pala a kahokaho:** Rottenness of the *kahokaho.*

The *kahokaho* is a species of yam which grows to a great size and is highly valued. It is a chiefly yam, that is, one especially suitable for presentation to a chief. Even if this prime vegetable has commenced to decay yet it is a *kahokaho,* and something better than the best specimens of many other kinds of yam. Besides what may be called its ethical qualifications due to its rank in the yam hierarchy it is a physically fit tuber, as the remainder of the flesh is not affected by the beginnings of decay.

14. **Taka i fonua mahu:** Going about or living in a fruitful land. 539 181

This indicates the general prosperity and comfort of a people when crops are good and none suffers want.

15. **Tatau pe tua mo palai:** The *tua* just like the *palai.* 539

The *tua* and the *palai* are two sorts of yam, of which the *tua* is much the finer. That which is excellent leaves its proper excellence, becoming the mere equal of things of no account; the chief descending to be no better than the commoner. 244 554

16. **Toukai mo hono lohu:** A crop of fruit and its *lohu.* 539

The crop referred to is the breadfruit. The *lohu* is the forked stick used for picking the breadfruit. When the breadfruit is ripe a man may find that the stick that he has used in a previous season is rotten, and so he has to get another. Probably these sticks are very seldom kept from season to season. The idea is that with the crop one must get a stick for that crop. So of the needs and opportunities of a particular period the men will be found to meet them. 245 [829]

17. **Ufilei fie ufi:** An *ufilei* that wants to be a yam (*ufi*). 539

Ufi is the general name for all kinds of yam. The *ufi-lei* is a small sweet yam. This indicates one of these small sweet yams that wants to be some other sort of yam. Applied to people who not satisfied with being what they are try to be like someone else. 244 554 829

18. **Utu ta lau:** Harvesting, cutting off leaves. 539

This is an expression from the yam harvest and indicates primarily a man who digs his yams before they are quite ready, when the tops will have died off. He strikes or cuts off the tops as he digs his crop. The application of such an expression in Tongan is similar to what it would be in English. 244

PLANTS AND TREES

19. **Akau tuu hala:** Tree standing (in a) road, and so liable to be splashed with mud, struck with knives, or otherwise injured. 539 824

This proverb or this explanation is probably modern, as before the introduction of wheeled traffic and of steel implements it would seem that the road-side tree was not exposed to especial injury. However, even under ancient conditions the road-side tree would offer itself first to those in search of timber. [313]

20. **Faifaimalie naa ke pakii ha lau telie:** Go carefully lest thou pluck (break off) a *telie* (*Terminalia catappa,* or *T. litoralis*) leaf. 539 784 829

This phrase is a warning to proceed with care lest a tabu be broken. We do not know its origin.

539 21. **Faka-hopo taokave:** Making *taokave* jump.

245 The *taokave* is a kind of coconut which bears small fruits, but carries
524 a large number on the bunch. As the fruits mature the press of so many
on the same stalk constantly forces nuts off the bunch. There is a boys'
857 game called *faka-hopo taokave*, which consists in a number of boys lying
down side by side all pressing in towards the center. Any boy who gets
shoved out of place on to the top of the other must then go to one of the
[578] ends. The expression is used proverbially of a number of people giving
someone the cold shoulder, crowding out an individual whom they do not
want.

539 22. **Fakatuamelie ki he ete mea oku tau he fuu telie:** Relying
[137] confidently on my thing that is hanging in the *telie* tree (*Terminalia catappa* or *T. litoralis*).

There is an old story about one who used to hang food in a tree for another to get. If the food were good and tasty it was hung in a *telie* tree, but if not very appetizing it was put in a *tavahi* tree *(Rhus taitensis?)*, The person for whom these supplies were left always anticipated with confidence that what he got from the *telie* would be first-rate, but never expected anything very good from the *tavahi*. Used generally of relying with full confidence on anybody or anything. (See No. 23.)

23. **Fakatuatamaki ki he ete mea oku tau he fuu tavahi:** Without confidence in my thing that is hanging in the *tavahi* tree.

To expect little good from any person or thing. (See No. 22.)

539 24. **Feji lou-ji:** Breaking off *ji* leaves.

747 This is recent, and is said to owe its being to the missionary's cow.
231 The leaves of the *ji* (*Cordyline terminalis*) are used for cow feed, and a
554 man who wanted to get into the missionary's good graces would recommend himself by his readiness to get food for the cow. Used generally of ingratiating services.

539 25. **Fokotuu niu:** Piling up coconuts.

245 Coconuts are very plentiful in Tonga, and large heaps are gathered. Applied to that which is in great quantity.

539 26. **Foui ne fai:** The *foui* tree did it.

461 This is the literal translation following the story told of the origin of the expression. The story is that a man and his wife lived together in a compound fenced all round, but at one spot a *foui* tree growing just outside the boundary leaned over within the compound. The woman often asked her husband to cut this tree down, but he procrastinated until at length a man of irresistible charm climbed up the tree and, thus gaining access to the inside of the compound, successfully paid his addresses to the lady of the house. To her husband's wrath she retorted that his own

dilatoriness in cutting down the tree had provided a mode of ingress to 539
the disturber of domestic peace; "It was your *foui* that did it." [461]

The application is exactly parallel to the English phrase that it is So-and-so's own fault. The full expression as given above is not always used, but one frequently says, "It is his own *foui*," that is, "It is his own fault."

27. Hange ha kainikavea: Like a parasite. 539

Kainikavea means a tree which has taken root in the living trunk or 824
branches of another tree finally growing so large as to envelop and conceal 571
its host. The banyan has this habit. Proverbially the phrase is used of a 829
supplanter, one who usurps the rights and privileges of another.

28. Hange ha lou milemila: Like a strip of *milemila*. 539

The *milemila* is a strip of the outer cuticle of the leaves of plants 245
such as the coconut and fan-palm. These strips turn white when dried and 824
bunches of them are used as head ornaments by warriors and dancers. 301
The expression is used of things that are thin and light, and of thin people. [826]

29. Hange ha lou vahivahi: Like a *vahivahi* leaf. 539

The *vahivahi* is a little plant found in considerable quantity on the 824
island of Eua, whose leaves are in constant motion even when the breeze 554
is scarcely perceptible. Used of one who is very obedient, is never still but 824
always running about doing the bidding of others.

30. Hange ha mahelei to: Like a strip of sugar cane. 539

Applied to a thin person, a narrow piece of cloth, and generally to 824
meagre, scanty objects, the comparison being to a thin, sharp-edged, pointed 826
piece of the outer bark of the sugar cane.

31. Hange ha niu afangia: Like a nut-tree blown by a hurricane. 539 824 522

Used especially of a man who sways with laughter, like a nut-tree swayed by the wind.

32. Hange ha niu auulu: Like a nut tree with the leaves cut off. 539

This is Tongan banter of a tall person. A coconut tree with the 824
leaves cut off is certainly a very lanky looking object. A touch of poignancy 826
is given to the expression by the fact that the trees so treated are never good bearing varieties, but an unfruitful kind that nobody cares much about.

33. Hange ha tahii toa: Like heart of iron-wood (*Casuarina equisetifolia*). 539 824 157

Hard, firm, as we say, "heart of oak."

539
of banana stem was said to be joined to the hibiscus. A strip of the 824
banana stem of course makes a very poor ligature, being loose fibered and 554
brittle. 643
764
565

41. Hu mata niu: Entering eye of nut.

There are three depressions at the top of the coconut, but only one of 539
these marks a hole. The unskilled person might try to open the nut by 245 ●
piercing one or other of the two false eyes, but the experienced man goes for the right hole. Hence the expression means to get right on the spot, but is used in the bad, or at all events unpopular, sense of kindness confined to one's own immediate relatives or friends; kindness confined to one particular spot.

42. Kai kape fifiji: Eating hot *kape* (*Arum costatum*). 539
One who has eaten a piece of this root at the pungent stage of its 262
growth will find his mouth so burnt that he will not be likely to join in [137]
the conversation and laughter of those about him. This picture of the man [521]
sitting silent with his stinging mouth is used of one who, ashamed of a wrong done by him, or for some such reason, sits taciturn in the company of others.

43. Koe vaavaa he koe tagata: Branchy, for 'tis man. 539
Man, with the wide and numerous ramifications of his relationships, 824
is the most branchy of all things. "Do you call so-and-so a many branched 829
thing? Why, it is nothing compared to man."

44. Malakia a moojipo: The *moojipo* trodden down. 539
This plant is frequently found in the road-ways, but lives on in spite 824
of being walked upon. So the ~~*moojipo*~~ has passed into a proverb of that 571
which bears up stoutly against ill-treatment and adversity: comes up smiling after every blow.

45. Mamalu a mohuku: Overshadowing of grass. 539
One is overshadowed by forest trees, and this means literally one who 461
undertakes to make a clearing on land where apparently large trees are standing, and finds that the "trees" are but weak and easily cut plants, "mere grass." So of any task seemingly formidable which, when undertaken, proves easy.

46. Motu lou-tou: Broken *tou* leaf. 539
The leaf of the *tou* (*Cordia aspera*) is very brittle; a slight pull 824
snaps the leaf completely asunder. So used of that which is broken right [137]
across, completely severed.

47. Nonofo ae makahunu moe niu motuu: The *makahuna* (hard 539
volcanic rock) living with the ripe coconut. 245
These rocks were used for making the stone adzes and were handy 412
for splitting open a coconut, and breaking it up if necessary. The phrase, 829

539 therefore, indicates the coconut living with that which destroys it. Used
245 of one who is in close contact with that which is his undoing. (Compare
412 No. 243.)
829

539 **48. Potopoto a niu mui:** Wisdom of a young nut tree.
245 A young tree will sometimes bear a crop as though it were clever at
858 that game, but will pass fruitless through another season. So children will
at times behave with all the discretion of adults, but such conduct cannot
be expected to be the permanent characteristic of the young.

539 **49. Tautefua a niu motuu:** A ripe nut hanging by itself.
245 There is only one nut on the stalk, but that one is perfect and ripe. A thing of which there are very few, and those few are of fine quality. A man who stands alone, but who is exceedingly capable.

539 **50. To lou oji:** Leaf fallen finished, that is, all the leaves fallen.
184 This is not a familiar form of expression in most parts of the Tongan group, in fact it is ungrammatical; it may have originated in Niua Foou where it seems that such a form is permissible. The phrase is not known, or at least not generally known in Tongatabu. Baker gives, "destitute"; poverty, or rather the poor, being represented as a tree denuded of leaves.

539 **51. Tupu lautolo:** Growing (like) *lautolo.*
824 The *lautolo* is a fast-growing, strong-creeping plant. To grow like this plant is to grow quickly and strongly.

539 **52. Tuutuu kau tala:** Stand about I'll tell.
244 Used for one who makes slighting or offensive remarks about another
578 who, unknown to the speaker, is near by and listening. There is a plantain called the *tuutuu-kau-tala.* Both the name of the plant and the meaning of the expression are connected with the legendary hero Muni, who was cast away at sea at, or before, birth and washed ashore on the island of Lofanga in Haapai. He was found and adopted by a childless couple of Lofanga, but as he grew to manhood his adoptive parents became anxious to get rid of him. Returning home one evening Muni overheard from just outside the house his supposed parents talking about him inside the house. He leaned against a plantain, of the sort now called *tuutuu-kau-tala,* and heard what they had to say. There is a couplet referring to this incident:

Hau ai o tuu kau talai	Come and stand while I abuse
Aeni ne ui ai he hopa ni.	You after whom was named this plantain.

539 **53. Ulu akaua:** Overshadowed with trees.
824 A tree that is dwarfed, unable to reach its full stature and vigor, by
571 reason of a crowd of other trees standing close about it. Used of a warrior who is overcome by the number of foes that press together upon him. Generally of one who, no matter how great his spirit and skill, is overwhelmed by the multitude of difficulties that confront him.

land. Tree stumps may be left in the ground or an attempt 241
made to burn them out. Depending upon the area to be [464]
cleared and the urgency involved, this work may be done [476]
by the men of the household, by a working-partnership of
several men, or else many men may be invited to participate,
each clearing a small section in return for the first yam-
harvest from the section cleared. Again, depending upon 244
taste and other factors of choice, one or more of several
different kinds of tubers may be planted in quantity.

Taro is easy to grow. Cuttings are planted and re-
planted each time tubers are harvested. The tuber takes
about a year to mature. The giant *taro (kape)* is best planted [221]
between the months of March to September. It takes about
eighteen months to mature. The gardens are occasionally
hoed to keep back the growth of weeds.

The sweet potato is also an easy tuber to grow. It is [221]
best planted in the months between March and October. It
is planted in big hills, perhaps five hundred hills at a single
planting. The tuber takes from four to five months to
mature. The garden is hoed once during this time.

Plantain shoots are planted from June to January. The 245
tree takes about one year to mature and at the end of this [221]
time about five shoots may be replanted from this one tree. A
man will have between forty and one hundred plantains
growing in his garden.

Breadfruit takes up to five years before it bears a good
crop. Coconuts take about four years to mature. The
coconut is generally self-seeding though plants may be
cultivated if the land is poor in coconut-production. Papaia, [262]
a staple article of diet, is self-seeding. No attempt is made
to cultivate this fruit. Pineapples may be planted at any 244
time of the year, requiring about a year before the fruit is 245
ready to harvest. Mango, oranges, limes, and lemons are
not cultivated but grow wild. Watermelons are planted 244
between June and March, but because of the ravages of the 221
fruit fly, cultivation is hazardous.

It is on the yam however, that the village cultivator 244
lavishes most care and attention. The yam is considered 262
one of the most delicate-tasting of Tongan tubers and the
best of Tongan foods. The first yams of the new season are

181 able than the mission primness of the Tongatabu maidens,
whose discreet deportment invites suspicion.

● 245 From the wharf one climbs a grassy slope, and straightway
one is in the orange-groves. The whole town is an
orange-garden. Beneath the dark shiny foliage lie piles
of rotting fruit, half-concealed by the rank couch-grass.
Some of the trees are bent with their green load, others
are white with blossom, for the crops succeed each other
342 with little intermission. Behind the long rows of trees
nestle the brown thatched houses, set down, as it were,
upon the grass like the toy cottages of a child.

133 There is no beach here. The shores of the inlet are steep
to, and the main road runs along the edge of the cliff.
344 On this road stands the "Palace," a barn-like decaying
structure of wood, from which the paint has long ago been
[352] washed by successive rainy seasons. Poor Laifone main-
[513] tained the place with magnificence,—that is to say, there
[264] were marble mantelpieces (never paid for), cut-glass decanters,
china, plate, whips, walking-sticks, boot-trees,
ornaments, and saddles scattered in heaps over the furniture
and floors, very dirty and in indescribable confusion;
while the royal master of all this luxury slept on the floor,
ate his meals with his fingers, and drank his liquor simply
from the black bottle without the intermediary of a cut-glass
decanter. But now even those glories have departed,
and the house is empty except when the king pays a flying
366 visit to Vavau. Beyond the "Palace" were the stores,
[439] built on the seaward side of the road for greater facility
in shipping copra, which comes next to oranges as the chief
563 product of Vavau. These stores, kept by rival traders
441 struggling for the custom of the passing Tongans, breed by

731 their concrete church, still standing like an island
[314] among the general wreckage, as a proof of
Divine warranty, a little tempered perhaps by
reason of a gaping rent in the tower. The
people were living in the open air, crawling into
the cover of their ruined houses to shelter from
[152] the rain. Poor souls! they bore their misfortunes
[245] with a light heart, though the crop of orange
trees, from which they get their living, were
uprooted, and the cocoanuts would not recover
[245] for two years. Every boat in the island was
busy bringing food from the less stricken villages,
and the men were saving something from the
wreck by turning the fallen cocoanuts into copra.

648 Next day we set forth in the ship's boats to
survey the German coaling-station in the bight
[133] of the harbour. The shore is here a coral reef,
[134] upheaved about fifteen feet above the sea. The
[311] soil is shallow, but, like all limestone formations,
very productive, and covered with plantations
648 and cocoanut trees. On the further side was
504 the open sea, for this part of the harbour is
a mere breakwater, tapering away to a boat
passage in the bight of the harbour, where the
land is only two furlongs across. The Germans
had done themselves handsomely, and had
allowed no concern for the welfare of the

Tongan landed chiefs are land hungry. The old practice 423
was to claim as much as possible of the neighbouring lord's 178
territory upon his death. Careful surveys now being made 425
by the government are fixing permanently the boundaries [428]
of hereditary lands, so that expansion of one's holdings at
the expense of some minor heir who is unfamiliar with his [656]
inheritance will soon be no longer possible. It is of interest
to note that the chief who would be Tui Tonga, if that office
had not been abolished, has by legal procedure in recent
years secured the return of lands improperly claimed by
others.

Euro-American culture has had a hand in transforming 361
the Tongan population from a rural one to a village-dwelling 177
one. The transformation had its beginning at the end of 178
the eighteenth century when civil war forced the people to [166]
leave their farms and seek refuge in fortresses. Thus village
life seems to have begun. Then came the missionary and a
great wave of religious enthusiasm which served to reinforce
the new village ties rather than to dissipate them. The [245]
copra trade and the scant attention required for the coconut
trees doubtless, in a negative way, has helped to perpetuate
the village life. The result is that modern Tonga is a country
of villages. The farms surround the villages at varying 241
distances and the villager makes periodic excursions to his 311
eight-acres of farm land. All of this has not been beneficial 178
to agriculture. Much land once cultivated intensively has
become bush. There are signs, however, of revival. A prominent
chief is inducing his people to give up village life
and dwell on their farms. Recently introduced agricultural
fairs seem also to offer a much-needed stimulus. It seems
likely that the next few decades will see a return to the
intensive cultivation of heathen days. The series of food 241
plants has been much enlarged by introductions. 178

Tracts of farm land are sometimes given the names of 103
foreign lands with which the Tongan has become acquainted
in school. More frequently, however, tracts within the villages
are given such names. The Tongan seems to have a 484
considerable interest in geography and he likes to travel. [181]
His geographic poems amply attest this. This love of travel [823]
and of topography is still rife. The monthly steamers and
the sailing passenger boats carry many Tongans from one
part of the archipelago to another or to more distant Samoa
and Fiji. Modern vessels continue to cater to the Tongans' [178]

The chief barrier to this development seems to be a general satisfaction of the commoners with things as they are. 642 They have always been content to leave things to the chiefs, and have no serious grievances to stimulate them to political energy. Democratic institutions are 000 seldom real or stable if they drop from the clouds; they become rooted in a society only when its people have learnt to appreciate and operate them, as a result of struggles to remove hardships. In Tonga progress 642 towards political democracy is retarded, not so much because the present government is rapacious of power, as because it is productive of popular good.

AGRICULTURE AND LAND USE[4] 241

The Tongan is a peasant, cultivating his compact holding in his own way, subject only to the easy and sensible requirements of the land laws.

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[4] The following tables provide a statistical summary of the nature of Tongan agriculture: 245

DISTRIBUTION OF FOOD TREES (1939 Census). 311

Group	Coconuts	Bananas	Pineapples	Other Food Trees
	%	%	%	%
Tonga Tapu . .	39	46	43	39
Ha'apai . . .	26	22	20	7
Vavau	26	23	26	35
Niuas	10	9	13	19
Total for Tongans	3,059	638	314	875
Total for Kingdom	3,260	682	335	890

DISTRIBUTION OF PRINCIPAL CROPS (1939 Census). 244 241 311

Group	Yams	Kumalas	Tapioca	Other Plants
	%	%	%	%
Tonga Tapu . .	55	57	42	28
Ha'apai . . .	14	25	38	22
Vavau	27	5	13	40
Niuas	4	13	8	9
Total for Tongans	1,504	600	1,245	1,671
Total for Kingdom	1,610	647	1,309	1,842

DISTRIBUTION OF LIVESTOCK (1939 Census). 231 311

Group	Pigs	Poultry	Goats	Cattle	Horses
	%	%	%	%	%
Tonga Tapu . .	39	36	44	78 (a)	60
Ha'apai . . .	29	26	23	3	15
Vavau	17	24	30	17	20
Niuas	15	13	4	1	5
Total for Tongans	19,120	49,744	3,484	1,024	5,016
Total for Kingdom	19,754	50,378	3,572	2,634	5,179

(a) The actual number is 2,058 of which 1,549 are owned by Europeans.

From the standpoint of his own needs, therefore, the Tongan is an 241
efficient enough farmer, but if European standards are considered his 434
farming leaves much to be desired.

One of the first things to impress the outsider is the enormous waste 311
of land, for, apart from a few clearings for the food plants, the farm is 241
largely given over to prolific weeds. Equally glaring are the primitive 241
methods of cultivation. Machetes, spades, push hoes, and an occasional [412]
fork are the only implements used, and no appreciation is shown of the use of animal manure or of any other fertiliser. Reflection will suggest, however, that these conditions may not be entirely due to agricultural backwardness. Intensive cultivation would exhaust the soil, and in the absence of local supplies fertilisers would cost more money than the Tongan could afford. Weeds may rob the soil of moisture, but they do not exhaust its fertility and have at least the merit of preventing soil erosion. Undoubtedly much more could be produced from the average farm, but probably only if fertilisers, cattle and implements were provided on a scale beyond the resources of most farmers.

To a certain extent the general faults of Tongan farming may be excused. It is less easy to justify the defects of its particular branches, apart from a recognition that they may arise not so much from a lack of ability or energy as from a lack of agricultural training and capital. Many of the crops and especially fruit are ravaged by serious diseases and pests, which the farmer does little to control beyond avoiding to
plant obviously damaged material. The copra is of relatively poor 245
quality, commanding inferior export prices because it is produced, 251
harvested, and dried in a very haphazard way. The Tongan usually gathers it only when he needs money for some specific purpose, and this casual attitude, together with the infestation of weeds about the trees, leads to a considerable wastage of nuts. There are few hot-air driers in use, the greater part of the crop being rather carelessly sun-dried.

Perhaps the worst of the Tongan farming is animal husbandry. Not 231
only is the stock inadequate and of poor quality, it is also badly cared for. Systematic efforts to provide feed are rare, the animals being left to forage for themselves. It is not surprising that they are scraggy creatures, too often suffering from serious diseases. Tuberculosis is par-
ticularly rife in both cows and pigs. There is little attempt either to [232]
control these diseases or to improve the stock by breeding.

133 [712] [368] ner in his book on the Tonga Islands. The summit of this mound is now crowned by a good chapel of native construction, which affords an excellent land-mark to navigators making for the anchorage; and it also stands as a very prominent emblem of the Gospel triumphs that have been achieved over the former habits of the people.

Looking eastward, Bagaimotu and a cluster of other islands, stretching away to the north-east, shut out the "*Hahake,*" or eastern end of Tonga, from sight, whilst *Hihifo* and the island of Atata bound the prospect on the extreme west.

632 The town of Nukualofa may be regarded not only as the capital of Tongatabu, but as the metropolis of the little ocean empire of King George Tubou. It has risen from the obscurity of a small village, and has become the centre of religious influence and the chief seat of political authority, while several of the ancient royal residences have been almost entirely deserted. It is partly indebted for [361] [797] its importance to its admirable situation on the seaboard, but most of all to the fact, that Christian converts from various heathen towns were drawn thither, during successive years, that they might reap the full benefit of Missionary instruction, and be freed also from the persecutions to which they were subjected by their heathen friends. A short description of this town will serve to indicate the general appearance and arrangements of all others.

361 [363] [351] [245] Nukualofa is intersected by tolerably wide paths, kept scrupulously free from all rank vegetation and dirt. These paths are bounded by the neat reed fences which enclose the *abis* or residential sections of the various chiefs and their retainers. These

enclosures are planted largely with useful trees, 361 [351]
such as the bread-fruit, banana, cocoa-nut, orange,
citron, shaddock, and a variety of shrubs whose [245]
overhanging foliage effectually screens the pathways from the intense heat of the sun. Very little
order is observed in placing the numerous houses
within these enclosures. There are no regular [363]
avenues or streets. In fact, a house is generally
placed where it can obtain the greatest amount of
shade from overhanging trees,—a matter certainly
of considerable importance in a tropical climate.
A casual visitor, therefore, can see but few dwellings even when he has entered within the *loto a*, or
fence of the *abi ;* and, until he hunts them out
amongst the abounding shrubbery, he wonders
where the people live.

A Tonguese house suits the few necessities and 342
easy habits of the people, but has none of the comforts so essential to a higher type of civilization.
With the exception of what may be called public
buildings, and a few of the dwellings of the chiefs
of highest rank, their dimensions are small, and
they contain but two apartments. They are, however, constructed with an eye to neatness and great
strength ; and when elaborately finished in the best
native style, their interior appearance is by no
means to be despised. The walls range from four 342
to eight feet in height, and are formed either of a 824
single or double fencing of reeds, which, when interlaced and bound by sinnet to the *tokotuus*, or stakes
and posts, planted all round the eaves of the building, resembles very much strong basket-work.
These walls are sometimes made more wind and
weather tight by the addition of a lining of plaited
cocoa-nut leaves ; but, at the best, they afford a

CHAPTER VI.

Richness of the soil—Native method of manuring—Banana Plantations—Bread-fruit and native bread—Varieties of edible fruits—The Coffee-plant—The yam, and method of its cultivation—Other edible roots—Kitchen vegetables—The Cocoa-nut tree, and oil manufacture—English manufactory at Foa—Cotton-growing in Tonga—Native ideas of labour—Timber trees.

The soil of the low islands is composed of a rich 134
black mould, with more or less of admixture with
sand, according to the distance from the sea. This
black mould, formed chiefly from decayed vegetation, ranges from three to six feet deep. In the
higher lands the soil varies from that of the black
mould to a tolerably stiff yellow and reddish clay.
Speaking generally, the arable soil rests either [133]
immediately upon the surface of a conglomerate
coral rock, or else upon an intervening stratum of
light clay and sand. Such is the natural fertility 242
of the land, and such also the rapidity with which [134]
vegetation grows and decays, under these tropical
skies, that the natives never think of employing
artificial means to improve the soil. They have,
nevertheless, a good knowledge of some of the best
principles of agricultural science. They understand 242
the necessity for a rotation of crops, and regularly 244
practise this in regard to yam plantations. At 245
suitable intervals they plant the yam grounds
plentifully with banana trees; by which plan
several great advantages are secured for succeeding
crops. The herbaceous nature of the trunk of this 245
tree, and the extent of surface presented by the 242
immense leaves, tend to accumulate and deposit a

245 vast amount of moisture in the soil during the
242 period of growth. In addition to which, no sooner
has the fruit ripened, than the parent tree is cut
down, and its juicy trunk and roots are left to
rot upon the surface. The process of decay is
rapid; and meantime the young sucker-plants,
which spring up from every parent stem, reach
maturity in swift succession, to be cut down in a
similar manner. These banana plantations are
allowed to remain during one or two seasons, after
which the ground is replanted with other products,
(244) or with the yam. As a rule the yam is not replanted,
in the same ground, until the lapse of two or even
242 three years. This system of resting the land, and
permitting the bananas to rot, unquestionably
311 answers all the purposes of ordinary manuring;
but it necessarily involves the occupation of a
much larger quantity of land, than would be
required, were the principles of European agriculture
adopted.

245 Perhaps there is no sight more distinctively tropical than that of an extensive banana plantation. In these islands all the varieties of the tree flourish in highest perfection. The plantain, (*Musa sapientum,*) so greatly used and esteemed in the West Indies, is not much thought of by the Tonguese; but all the other sorts, included in the *Musa paradisiaca*, or banana family, are extensively cultivated. The fruit hangs in single bunches upon a strong stem issuing from among the leaves. Each bunch will weigh from thirty to even eighty pounds. The fruit is of various colours, and of great diversity of form, according to the description of tree planted. It is usually long and narrow, of a pale-yellow, or dark-red colour, with a yellow or

slightly pink farinaceous flesh. The best sorts 245
surpass the finest pear in excellency of flavour. [262]
These are eaten raw, or they may be baked, or [252]
stewed, according to fancy. The Chinese dwarf
banana, (*Musa coccinea*, or *M. Chinensis*,) was [137]
introduced only a few years since, and has already
been widely spread through the islands. The fruit
is of a very delicate flavour, and the stem of this
species not being more than four feet high, it is
much better able to endure the periodical gales
that level to the ground all the taller sorts. It has,
consequently, become a great favourite with the
people, and will, probably, supplant many of the
others entirely.

No use has yet been made, by the Tonguese, of 824
the stem of this tree, in the manufacture of cordage, [283]
as is the practice in Manilla and elsewhere. Its
leaves, however, serve for several useful purposes. 824
One leaf can be readily fashioned, in a few minutes, 415
into at least half-a-dozen drinking cups; while by
gently heating an entire leaf over a fire, through
which it is rendered at once pliable and tough,
wrappers can be made in which to bake fowls so as
to retain their gravy, or in which even fish-soup can
be cooked without any loss of the liquid. Indeed, we
have frequently seen a banana-leaf bag, containing
a gallon, or more, of cocoa-nut oil, that had been
carried safely therein for many miles. Portions of 824
the juicy stem of the tree are always brought, at 515
the conclusion of a meal, to be used by the guests,
instead of soap and water, in cleansing the fingers,
after these have performed the duties of knife and
fork. It does this very effectively, when well
shredded, by rubbing between the hands.

Among other edible fruits of Tonga may be 262

262 reckoned the following, which, being now well known, it is not necessary we should more minutely describe. Foremost is the bread-fruit. (*Artocarpus incisa.*) Of this fruit there are said to be at least fifty varieties. Those common to Tonga are known under the generic name of *Mei*, with distinctive appellatives attached to that word descriptive of the different kinds. This fruit, in addition 262 to being eaten, cooked in the usual native fashion, 252 either boiled or baked, is also made into *ma* or bread. The fruit is beaten up, and incorporated with the sweet banana, and scraped cocoa-nut. It is then divided into small balls, or portions, which are buried in a large mass underground, there to undergo fermentation. The *ma* is left buried for many months, after which it is fit for food, and will keep, if not exposed to the air, for a long time. When the *ma*-pit is opened, a very strong and disagreeable odour gives intimation of the fact, to a considerable distance: while the bread itself, to a European palate, is even less acceptable than the black bread 262 of Russia. In taste it resembles what a mixture of barley-bread and rotten cheese might be supposed to be. It is nevertheless very nutritive, and is a good resource in seasons of famine, and in times of war.

● 245 The papaw-apple, (*Carica papaya,*) or *oliji*, abounds. There are also great quantities of shaddocks, oranges, limes, citrons, and lemons, all of which are included in the general name of *Moli*. 244 Several sorts of pine-apple grow in the highest perfection and abundance. They require no particular care in their cultivation; and, the ground being so rich, the suckers need not be removed, but may be allowed to run to fruit as well as the parent plant.

22: West M-3 (1846-1855) 1865 OU9 Tonga OU9

parent plant. The custard apple, (*Anona squamosa,*) is somewhat rare, and so also is the Tamarind tree, of which there is a very fine specimen in the Mission garden at Nukualofa. 000 245

The *fekika* or Malayan apple, (*Eugenia Malaccensis,*) of which there are two species, red and white, is much thought of. The *vi*, however, is more esteemed by European settlers, as being the best substitute for the English or American apple. In the Friendly Islands it does not attain the large size described by Dr. Seemann as characteristic of this fruit in Fiji.* We have never seen it larger than an ordinary English apple. The *Tava*, a kind of plum, (*Pometia pinnata,*) is said to have been brought to Tonga from the Fijis, and if so, it likewise has degenerated by the change; for, while in Fiji it attains the size of a pomegranate, it never exceeds that of a large pippin in Tonga. The fruit is slimy, and very insipid to European taste. The *Ifi*, (*Inocarpus edulis,*) produces a large species of chestnut, which is seldom eaten by the people, except in times of scarcity. The leaves of this tree, when strung together into the form of a necklace, are worn by captives taken in war, or by any offenders, when brought into the presence of their lordly superiors, to *hu*, or make submission and obeisance. [137] [262] [824] [301] [571]

Several of the best varieties of sugar cane, (*Saccharum officinarum,*) are cultivated, under the generic name of *To*. The soil and climate are highly favourable to the luxuriant growth of this valuable tropical product. But the natives have not, as yet, been taught the method of manufacturing sugar, and therefore they have had little 249

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* "Viti: an Account of a Government Mission to the Viti or Fiji Islands," p. 316. [113]

249 inducement to cultivate the *To* to any great extent. When they have attained this knowledge, they will readily find an open market in the Australasian Colonies for all that they can produce; and thus another source of national prosperity will be opened up which at present lies undeveloped.

245 The coffee plant was introduced only a few years
[137] since, (1852,) and has succeeded well. The plant
grows rapidly, and bears profusely. The beans are
[643] large, and of good quality. King George himself
has devoted considerable attention to its cultivation,
and, in due time, it also will become a valuable
addition to the exports of the land.

245 The natives, we may here remark, do not fail to
magnify, in an extraordinary manner, the value of
435 anything new that may be recommended for culti-
177 vation, either by Missionaries or other foreigners.
They seem to fancy that whatever the white man
likes, and pays attention to, must be "*koloa lahi,*"
great riches. Even coffee beans have awakened
mysterious notions of value, in some native minds,
as the following incident will show. A woman
245 belonging to the island of Haano, in Haabai, came
435 from thence to Lifuka, a distance by sea of about
439 twenty miles, in a small canoe, for the sole pur-
pose of bartering at our Mission station, what she
[505] thought was a very valuable thing. Presenting
herself before us, she took from her bosom a small
piece of white native cloth carefully tied up and
tightly knotted. Thinking, from the appearance
of the package, and the manner of the woman,
that she had brought some pearls for sale, we
desired her to show them. With due deliberation,
the package was unfolded, when, behold, it dis-
played just half-a-dozen coffee-beans! It would

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be impossible to depict the air of utter disappointment, 245
mingled with lingering incredulity, which 435
the woman's face betrayed, when a large canister 439
of coffee-beans was placed before her, accompanied by an explanation of their true value. Upon inquiry, we leant that she, and her wise lord at home, having heard of the new and valuable plant, secretly obtained one, and after tending it carefully, they thought to make a good thing of it, by taking its first fruits for sale to the Missionary. Considering the poor woman's ignorance, as well as her simplicity, and also the blank disappointment that met her, after such a long journey, we gave her a small present, as an encouragement to further cultivation of the plant, but sent her home with wonderfully altered ideas respecting the costliness of the coffee-bean.

The yam, or native *ufi*, (*Dioscorea alata*,) includes 244
a great variety of this most valuable of all the edible roots of the tropics. It is the chief article [262]
of vegetable diet raised by the Tonguese; and, probably, it is cultivated in no other region to such high perfection or in such quantity.

The Tonguese do not believe at all in the Fijian [171]
practice of putting yam settings into hard and unprepared soil; nor, indeed, are the Fijians themselves uniform in their mode of cultivating the root. The plan adopted in Tonga involves great care and labour, but is rewarded by large crops of the most valuable esculent root to be found in the world.

After the surface of the ground has been thoroughly cleared of bush and weeds, the first part of the operation is that of digging the yam-pits, or *bukes*. These are dug of a diameter

137 America, the plant will be a valuable accession to the edible resources of the people.

137 In kitchen vegetables there is no great variety. 244 The natives have been accustomed to use several esculent leaves, to which foreigners have added cabbages, some excellent descriptions of pumpkin, and the vegetable marrow. This latter was first taken to the islands by the late Sir Everard Home, of Her Majesty's Royal Navy. All these grow readily, attain a large size, and are of good quality. Cucumbers, carrots, radishes, parsley, and turnips, have also been raised, and will no doubt succeed well in proper localities, and will become abundant. Their culture, however, thus far, has been confined, almost entirely, to the gardens of foreign residents. 244 The truth is, the natives are firm believers in the supremacy of the favourite yam over all other vegetables whatsoever; and to that, therefore, they devote the greater part of their time and skill. In this opinion and course they are quite correct, because the yam is to them the chief "staff of life." Anything, therefore, that would diminish the cultivation of the yam, would soon prove a serious 000 calamity to the people. At the same time there is plenty of scope for the further introduction, and large cultivation, of various foreign products; all of which will add materially to the wealth and comfort of the inhabitants.

● 245 Of the cocoa-nut tree we have hitherto said nothing; but this tree, and its fruit, are unquestionably the most abundant, and characteristic, of the country. Whole forests of these beautiful palms flourish in all the islands, whether large or small. In those that are of moderately high elevation they crown the hill-tops and sides, while in every quarter to which the eye may be turned, the land 245 appears clad with their graceful foliage, down even to within a few feet of the sea itself. Proximity to the ocean, and a sandy soil, appear rather to favour than to hinder the rapid and healthy growth of the tree. Some of the finest and tallest specimens are met with on the shores of the lowest islands. In such situations they attain an elevation of eighty and even ninety feet. Hence an approaching voyager discovers the tufted heads of these palms in the distance, long before the land itself, upon which they grow, becomes visible.

The natives reckon at least nine different kinds of cocoa-nut trees, for all of which they have distinctive names, such as, the *niu-kafa*, *niu-ui*, *niu-leka*, &c. All these are known and included under [114] the generic name of *Niu*; so that Dr. Seemann appears to be in error when he says, that "the Fijians are the only people who in their barbarous state had a collective term for the great natural order of palms."*

In addition to the multifarious uses to which 439 every portion of this tree has been devoted, from 434 time immemorial,† the natives now derive from it [824] a large revenue of wealth, by the manufacture and exportation of cocoa-nut oil. Nothing of this kind 439 was done, of any importance, before the year 1846. 434 At that time the Missionaries adopted various mea- 797 sures calculated to encourage the manufacture of the article, and to facilitate its sale to resident foreign traders. They also explained the duty incumbent upon professed converts to the Christian faith, and especially upon all members of the church,

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* Dr. Seemann's "Viti," p. 367.

† Ellis's "Polynesia Researches," vol. i., pp. 50-59.

[113]

timber is obtained. The *toa*, or iron-wood tree, 313
(*Casuarina equisetifolia*,) is somewhat abundant, [137]
but it is not much used by the natives, because
of its excessive hardness and heaviness. Clubs [411)
and spears were made from it in former times.
The large posts required for buildings are obtained [342)
from the *koka*, whose timber is very durable in
the ground. It likewise affords the best firewood;
and a dark liquid which exudes from its trunk, [314]
when the bark has been scraped off, is employed in [386)
stamping patterns upon the native cloth.

Some of the most stately and magnificent trees
are only fit for firewood, and some not even for
that. Among these may be reckoned the *ovava*, [137)
a species of banyan; the *buko*, (belonging to the
natural order of *Bombaceæ*,) and the *gatae*,
(*Erythrina corallodendron*.) This latter tree is [245]
very commonly planted to distinguish the bound- [423)
aries of land belonging to different proprietors.

Having considered, so far, the natural produc- 128
tions of the islands, as a whole, we shall now resume 114
our personal narrative, by taking the reader to
Vavau, where the first years of our residence were
spent.

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361 Beyond these stands the *Bou valu*, a large open
[344] building devoted to the reception of strangers, and
to the transaction of all public business. Around
[351] this place there is a *malae*, or grassy sward, of
several acres in extent, fringed by cocoa-nut and
[764] cedar trees; the prospect being bounded on the
right by the hill of Neiafu, at the foot of which lies
a burial-ground, where the remains of two missionaries
have been interred, near the tombs of the
leading native families.

361 Proceeding a little further inland, the Chapel is
reached. That which stood there in 1846, mea-
368 sured one hundred feet by forty-five. Turning
797 from thence to the left by a road leading towards
[491] Talau, the Mission premises were soon reached.
These consisted, at the time specified, of a large
printing-office, containing three presses with all
their necessary appurtenances; and beyond that
building lay the dwellings required for three Mission
families. These were erected upon separate
[417] *abis*, or allotments of gardening land, the whole
being surrounded by a neat native fence, with a
[245] magnificent row of large orange-trees lining the
entire frontage to the road.

797 After the bustle of landing our stores was over,
the active duties of Mission life immediately commenced.
Among these, the acquirement of the
797 language was felt to be the thing of greatest im-
122 portance. We had not been idle in this matter
since reaching the islands: but still, in the prevailing
religious excitement, and the consequent
increase of labour devolving upon our senior colleague,
Mr. Turner, we saw abundant reason for
prosecuting its study with unsparing diligence.
[123] We longed to take an active part in the religious

grant of not more than 1 rood 24 perches in a town or village area as a
town allotment. Each allotment is called an *api*; the former *api tukuhau* 425
and the latter *api kolo*. There appear to be only two legal restrictions on 884
where the allotments may be located: the tax allotment and the town 423
allotment must be in the same locality[14] and the holder of an hereditary estate may refuse a grant to someone from a different area if there is not enough land on his *tofia* for all the people living in his own locality. Subject to these reservations, a man who applies for an *api* will normally be granted one if land is available, whether the estate is Royal estate, Noble estate or Government estate.

Although no one may hold more than one *api tukuhau* and one *api* 427
kolo, a man may receive a block of bush land of 12½ acres at a rental of 423
4/- per annum if he forgoes his *api kolo*.[15] Holders of land on hereditary estates may, in addition to the *api tukuhau* already in their possession, be granted a lease of an area not exceeding 5 acres at a nominal rental for a period not exceeding 50 years. Holders of tax allotments on Government estates may be given a lease over a greater area for the same period provided that the lease does not exceed the area of the allotment they already hold.

Each tax allotment carries a tax of 8/- a year and may be forfeited 425
if the holder defaults from paying this amount for three consecutive 423
years. The amount is collected by the Government which pays it over 651
to the member of Royalty or of Nobility from whose estate it comes, or holds it as Government revenue if it comes from a Government estate. But of moneys received as rent from leases on hereditary estates, only 90 per cent goes to the holder.

As the Crown owns all lands, all applications for grants must be 423
made to the Minister of Lands; applications for leases must also be 425
made to him, but can only be authorized by Cabinet. The Minister 427
approves grants only under certain conditions. No land holder may sell
his holding or dispose of it in any way; nor may he enter into any [645]
agreement for profit or benefit regarding the use or occupation of his land other than in the manner prescribed by the Land Act. An alien [609]
may not hold or occupy land except as provided for in the Act, and a land holder may not permit an alien to reside on his holding unless the alien has obtained a permit or lease. An allotment holder must, within [245]
one year from the date of his grant, have growing on his allotment 200 coconut trees planted at intervals of 30 feet and must keep his holding free from weeds. He is not allowed to mortgage or make an agreement pledging or charging his growing crops. And he may not be expelled [645]
from his allotment by the holder of the *tofia* except on the authority of the Minister of Lands.

While disposal of land by individuals is absolutely forbidden by 423
law, there are provisions in the Land Act by which land may be 428
inherited. 425

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[14] i.e. village locality. This is not coterminous with the *tofia* area, for people in one village may hold land in different *tofia*. This restriction simply means that a man who holds a town allotment in one village cannot hold a tax allotment in another village or in another part of the kingdom.

[15] i.e. he can have the equivalent of 1½ *api* at half the price of one. For a fuller treatment of the land law of Tonga, see Meek 1949.

This sample is too small, but for what it is worth in the absence 434
of a larger sample, the correlation coefficients between labour and pro- 592
duction and between land and production suggest that money income 423
varies more readily with the quantity of labour available than with the 433
amount of land; i.e. a man is more likely to obtain a greater income by working harder than by increasing his land holding.[27] Uneven as it is, therefore, the distribution of land exerts only a minimal influence upon the amount of money obtained. This may partly explain why an uneven distribution of land tends to be left undisturbed; but this latter tendency may be tolerable only at the present level of economic development and may tend to disappear at a higher level.

6—LAND USE AND LABOUR

The legal provision relating to the planting of coconuts at intervals 311
of 30 feet is, by and large, followed consistently on the majority of the 245
api I have seen. Amongst the coconut trees there would be food and 244
cash crops of several types, bananas, taro, yams, sweet potatoes, *manioke*, and even pineapples and water melons. In general, these are not planted in sharply defined plots but are interspersed one amongst the others, so that in an intensively cultivated *api*, members of all species would be found on each square chain of ground. This is more or less the general pattern, although there may be varying degrees of emphasis upon particular crops in particular parts of the *api*. Varying the pattern of emphasis would appear to me to play a similar role to straight out rotation.

The coconut trees belong to the planter but are heritable with 423
the land on his death or secession; and as their normal productive life 428
is 50 or 60 years, they may change hands several times during their
lifetime.[28] But the other crops, requiring from three to eighteen months to mature, are the property of the planter, whether he be the legal holder of the land or not.

The distinction between permanent and annual crops makes it 423
easier to understand all the sharing of *api* referred to in the previous 311
section. For while the current holder of an *api* owns the coconut trees 241
and other permanent resources, he need not have the whole *api* under 476
the less permanent crops at any one time.[29] This gives him room to permit a friend or relative to plant for himself a crop of taro or yams

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[27] My calculations produced correlation coefficients of $r = .32$ and $r = .54$ for land and labour respectively.

[28] The evidence of the 107 *api* which I studied shows that several of them had changed hands twice or thrice in the previous five or six years.

[29] The Beagleholes quote a man who estimated that up to twenty cultivators and their families can live off one *api*, Beaglehole 1941:18, but it is not clear whether this refers to an ordinary *api* of 8¼ acres or to one of the larger ones which may be up to 20 acres in area, Beaglehole 1941:17. In this connection it may be interesting to note that in a village of about twenty households which I studied in Fiji, the total area covered by food crops in various stages of development was found by detailed measurement to be 8.1 acres for all households.

The *kautaha* is described by one informant as a "big society". It is 476
formed for a specific purpose and joined by men interested in achieving 241
this purpose. One example would make the matter clear. In one village
I visited there was a *kautaha* with a membership of about 40 men, 245
comprising the majority of the adult males in the village, which was [462]
formed for the purpose of extending banana plantations. The overall target was that each member should have 1,000 banana shoots planted strictly for himself by a certain day in December; and once this overall aim was agreed upon, they split themselves up into four *tou ngaue* of 9 or 10 members each for the purpose of actually doing the work on the land. While the *kautaha* as a whole was interested in the progress of its members towards the target, the actual organisation of work was left to the various *tou ngaue*: these were the media through which the members ensured that their own bananas were planted. A lot of hard work was carried out in clearing the bush and planting the shoots, and on the appointed day the leading members of the *kautaha* did a complete tour of the plantations of each member to ensure formally for the *kautaha* that the bananas had actually been planted. It was an almost ceremonial affair, ending with the consumption of an elaborate feast.

The *tou lalaga* is the women's work group formed for the making 476
of *tapa* cloth. The task of joining together pieces of beaten bark into 287
large pieces of *tapa* cloth is a laborious one requiring the labour of [462]
many hands, and for this purpose women would call upon their friends to come and help. The friends in their turn would call on their own friends, and in the end 50 or more women may be involved. In this case the women are fed by the owner of the *tapa* cloth.

7—KINSHIP AND LAND USE

There are two important ways in which fully autonomous households 241
may be connected with one another through use of the land which 592
they work. In the first place, when land is short and a number of 476
families have to go without, they can usually make do by sharing the use of the *api* of others or by using the *api* of those who are away from the village. In the second place, a group of brothers or of a father 241
and his sons, although living in separate households and owning 592
separate *api* at law, may combine together their entire holdings and 593
work them as a single unit. In the village under study there were two 476
clear-cut cases of this sort. In each case the *api* concerned were contiguous, and clearing, at which the men concerned worked together, ranged from one *api* into the next. Copra was certainly produced jointly [245]
and the proceeds controlled by the senior member; but I am uncertain whether food gardens were individually owned.

In both cases, kinship is an important factor in the alignment of 592
households. Of the 19 households that share the use of the *api* of others 241
in the village under study, 10 share with related households and 9 476
share with unrelated ones. Of the 9 that share with unrelated households 602
5 have no relatives in the village anyway, leaving only 4 which

161 population movement and the rapidity and extent of its growth since
1956 are likely to have important consequences which will bear
162 heavily on traditional political, social and economic customs and
166 practices throughout the kingdom. Until the mid-1950s, population
361 movement was more especially to rural Tongatapu rather than to
Nuku'alofa. Thus during this period (1931-56) Nuku'alofa's annual growth rate (5.2 percent) was less than that of rural Tongatapu (6.3 percent), but since then the growth rate of Nuku'alofa (7.4 percent) has exceeded that of rural Tongatapu (5.3 percent). The most urban part of the town, Kolofo'ou, grew at an even faster rate (8.6 percent) while nearby Havelu Loto, the centre of the only sizeable industry on the island,[17] grew at the fantastic annual rate of 35.7 percent between 1956 and 1966. Where village growth exceeded or nearly approximated that of Nuku'alofa, it was either in very small villages, where an influx of a handful of settlers would give apparently spectacular increases, or in settlements to the centre and east of the island for reasons noted above. In 1956 Nuku'alofa contained 29 percent of Tongatapu's population and 16 percent of that of the kingdom; in 1966 these percentages had risen to 33 and 20 respectively.[18] This demonstrates both the increasing importance of Nuku'alofa in terms of total population and the marked tendency for population movement to Tongatapu to be urban-orientated.

[554] Factors *pushing* people out of the outer islands and *pulling* them
towards Tongatapu and Nuku'alofa are: the greater opportunities for
[511] social mobility in recent years: the changing economic needs of the
[505] average Tongan; easier transport between islands; and, more recently,
[207] the advertising (over the Tongan radio) of the attractions of Nuku'alofa;
[447] overpopulation; land tied up in title disputes and in other ways kept
[423] back from distribution; the low price for copra; two hurricanes in the
[435] northern islands in 1961 and 1963; and the decimation of the banana
[132] by black leaf streak and other diseases in Vava'u. If one single cause
[245] can sum up these various and interrelated factors, it is the need for
money.[19]

It is not possible to know which islands and villages have recently contributed most to Nuku'alofa's growth, for the 1966 census contained
[127] no special statistics on towns. The following remarks, therefore, are
[101] based mainly on information extracted from the 1956 census sorting

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[655] [17] Quasi-government industries producing coconut by-products and furniture.

[18] Of the other two towns, Neiafu contained 23 percent of the Vava'u population in 1956 and 26 percent in 1966; the respective figures for Pangai-Hihifo were 28 and 25 percent. Neiafu grew at an annual rate of 2.5 percent; Pangai-Hihifo lost population (—0.5 percent p.a.)

[19] Walsh (1964): 179-197 discusses migrants' reasons for moving to Nuku'alofa. Some implications of these factors are discussed below. See 'Mobility and Economic Development.'

tensions and compulsions towards growth at subsequent points.'[29] 179 It is not easy to reconcile such a proposition with the Tongan situation. Firstly, Nuku'alofa is not, at least as yet, a 'growing point' in the economic sense, for it lacks the industrialisation which is the 'dynamic force' of development.[30] With barely seven percent of those employed [464] engaged in some kind of part-manufacturing or processing, it generates little of its own wealth. Secondly, with so many of its people dependent [434] on agriculture and with a low per capita income, Nuku'alofa does not [433] stimulate agricultural growth in the outer islands. Lastly, it has virtually [659] no private sector capable of providing investment and government funds are directed mainly towards transport, and services, most of these in Tongatapu.

The resources of Tonga are limited. Agricultural exports accounted 433 for 97 percent of all exports in 1967; coconut products representing [439] 49 percent and bananas 45 percent. As the greater part of the income [651] of government, which is the main investor and employer, is derived [464] from these sources, the level of agricultural production is of vital concern for overall development.[31] The promotion of tourism may increase [457] income levels in Nuku'alofa to the extent where this will ultimately [648] 'trickle down' to the outer islands, and sizeable aid from Britain may ensure an adequate infrastructure for development, but development itself seems firmly based in agriculture, for, with such limited resources, industrial development and growth must originate in the countryside.[32] If this proposition is correct, concentration of resources in Nuku'alofa [179] is unlikely to generate economic growth, at least for a long time, and with population increasing at its present rate this may be too long a time to wait if social harmony and the present social order is to be maintained.

In the meantime, copra production has declined by 50 percent 433 (1957-67), and while banana production has increased by over 280 245 percent, most of this increase has come from Tongatapu which produced 83 percent of exports in 1967.[33] The low level of copra production can be traced largely to neglect in one form or another, and this is likely to affect trees now being planted with British government aid money. I would suggest that neglect stems mainly from these causes:

1. Agriculture generally is held in low esteem, and this influences the amount of money devoted to agricultural development.

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[29] Hirschman (1958): 190, 184.

[30] See Myrdal (1957): 29.

[31] The quasi-government Copra and Produce Boards are in this sense included with 'government'. [655]

[32] For criticism of development fund allocation see Walsh (1967a).

[33] Banana exports 1967 (percent): Ha'apai 9.7, Vava'u 0.8, 'Eua 6.3; Copra exports 1967 (percent): Tongatapu 48.5, Ha'apai 20.2, Vava'u 23.9 (the highest for seven years), other 7.3. [439]

42: Walsh K-4,5 (no date) 1970 OU9 Tonga OU9

433 2. Growers suffer from a lack of incentives. One example of this
245 is the low price they are paid—45 percent of that obtained by
[435] the Copra Board.

[434] 3. A feeling of malaise and neglect by government in the outer islands.
[829] They have received directly only about 10 percent of development
moneys, yet government needs to be *seen to be active* in this and
other ways.

[829] 4. A fatalism which assumes that God and Government will eventu-
[181] ally provide, which obviates the need for individual action.

[829] 5. The panacea of tourism, the discovery of oil and other ventures
that are expected to produce Kuwait-type returns. This obviates
the need to turn seriously to agriculture.

181 In a society where initiative belongs to the chiefs, government is
622 the only significant innovator. As most of the reasons for low production
565 seems to be cultural in origin, cultural solutions are most likely to solve
659 them. This, initially, means a reappraisal of priorities and a reallocation
006 of funds; a close examination of present methods of land use and land tenure; a revised education system which places less stress on academic learning; and the use of radio and other media to 'play-down' the attractions of Nuku'alofa and Tongatapu, for these are often highly exaggerated in the minds of the islands' population. Only direct government intervention can reduce migration to a rate where it more closely approximates economic development.[34] And as all of Tonga is a 'backward area' in relation to the countries with which it has economic connections, direct government intervention from these countries is also necessary to stimulate and maintain development. This, basically, requires better trade and shipping conditions and a higher rate of investment, not an increase in aid which in itself is unlikely to stimulate growth.

CONCLUSION

161 In summary, population movement is not new in Tonga. While some
162 older patterns, such as dispersed settlement, the full occupance of the
361 smaller islands adjacent to Tongatapu and 'Uta Vava'u, and the siting
166 of settlements in areas where there is a balance of land and sea resources, appear to have gone or been severely modified, other trends suggest the re-establishment of older patterns—the resettlement of some of the volcanic islands, possibly a more widespread use of the interior of islands, and the pre-eminence of Tongatapu and its capital, Nuku'alofa, which in a limited political sense could be considered the modern counterpart of ancient Mu'a with all its attendant powers of central authority. Other patterns continue—population moves among

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[34] Cf. Myrdal (1966): Chapters 3, 4.

gardeners try to plant one and sometimes two *ma'ala* 244
a year. Giant taro (*Alocasia macrorrhiza*) and/or
plantains and bananas are usually planted with [245]
the yam (*Dioscorea alata*), in rows 12 to 18 feet
apart. In the more densely populated areas taro
(*Colocasia esculenta*) is often inter-planted in the
same plot, but in central and eastern Tongatapu
this practice appears less common. When the yam
is harvested it is replaced with taro, sweet potato
or cassava. Taro is harvested as needed and as the
tubers are dug the stems may be replanted for a second crop. Cassava may also be replanted one or
more times, up to five successive crops being taken
before the land is rested. The cropping sequence [245]
may sometimes end with plantains and bananas
rather than tubers, with the former crops being
inter-planted with the last crops of taro or cassava
and being left on the land when these are harvested.
Apart from yams, sweet potatoes may also begin a
cycle of cropping. They are usually the first crop on
sandy *tou'one* soils and are frequently grown on
newly cleared land in the grassy areas of central
Tongatapu. The next crop is then generally cassava, [245]
and bananas and plantains may be grown with the
tubers.

Although definite but flexible patterns of crop 241
succession and crop association (or inter-cropping)
can be distinguished, the value of these is uncertain.
Inter-cropping as practised in Tonga probably has
some advantages. The growing of a variety of crops
together provides a better cover for the soil, and
consequently protection from sun and rain; the
labour needs for weeding are also reduced. Different
crops make different demands on the soil, and intercropping may therefore be a more efficient way of
utilizing a garden area. On the other hand the pat- [242]
terns of crop succession appear to be related more [244]
to the requirements of the various crops than to [245]
any attempt to develop rotations which conserve
soil fertility, and the basic crops which are rotated
are all tubers, with the exception of bananas and
plaintains. Yams are planted first because they 244
require a loose soil well supplied with plant nutrients, conditions best found in land newly cleared
from bush, while sweet potatoes, taro and cassava
are less demanding and can be planted on land

[p. 59-A]

already cropped. Sweet potatoes do better on lighter 244
or less fertile soils, which do not promote excessive leaf growth at the expense of tubers, while taro is generally grown on heavier soils. Cassava can be grown practically anywhere, and because it yields well even on poor soils is frequently last in the cropping sequence.

After a cropping period of from two to about
five years the plot is bush fallowed. The cessation [245]
of gardening, however, is often gradual as taro,
cassava, bananas or plantains may remain on the land and continue to be harvested for one or more years after cultivation of the plot has ceased, a practice which is not uncommon amongst shifting cultivators (Webster & Wilson, 1966). Taro may also be planted and left in the ground as a reserve against future needs.

Some cash crops are grown as an integral part of 241
the bush fallow system. Bananas, for example, are
frequently planted as part of the cropping sequence 245
and yield for only a few years before the land returns
to bush. At present, however, with the very marked 245
growth in banana exports over the last few years 439
bananas increasingly are being grown in separate 242
plantations, though often with some inter-cropping
of food plants, and chemical fertilizers are being
much more extensively used both to improve yields
and to extend the life of the plantation. Watermelons 244
are another, but minor, cash crop grown by the bush fallow system, as the first and sometimes the only crop planted on newly cleared land.

Coconuts, on the other hand, as a long-term tree 245
crop, are not cultivated as part of the bush fallow
system, but are unevenly scattered over part or all
of each allotment. Most farmers prefer to keep part 245
of their land free of coconuts, because they say that 241
the shade cast by the palms lowers the yields of the crops grown under them, and in the past a common practice was to plant half of an eight and a quarter acre allotment in coconuts and leave the remainder fairly clear. Particularly in Ha'apai, however, those with small allotments (around three to five acres) have found it necessary to plant all their land to ensure a reasonable cash income. Consequently the Tongan farmer now rotates his gardens around

[p. 59-B]

an allotment partly-to-fully planted in coconuts, and two types of land use (which in neighbouring parts of the Pacific are largely kept separate) are increasingly being combined on the same site. 245 241

While inter-cropping amongst coconuts has become common in Southeast Asia and has many economic and technical advantages under systems of more continuous cropping (F.A.O., 1966), under present Tongan conditions the result is not satisfactory.[1] Coconut yields may be temporarily improved by the occasional clearing of the bush growth for new gardens, but the burning of the cut vegetation scars the base of the palms and once a garden is finished the fallow vegetation is allowed to grow up around the coconuts to form a tangled mass. This fallow growth not only competes with the palms for plant nutrients and soil moisture but also makes it difficult for the grower to collect the nuts. Competition also comes from the crops planted, for no attempt is made to keep a clear space around each palm and, except in the case of bananas and watermelons, no fertilizer is used. Consequently only where a cash crop that will pay the cost of fertilizing is grown is inter-cropping probably of benefit to coconut yields, and where coconuts and food crops are grown together the yields of both are reduced by competition, shading and damage to the root systems of the coconuts. As yet, there is therefore no satisfactory integration between the bush fallow food cropping system and the coconut plantation. [171]

THE EFFECT OF POPULATION GROWTH ON AGRICULTURE 121

The effect of population growth on the agricultural system outlined above can be studied by examining the system in the more densely populated areas of the Kingdom (the areas in which the system is now under the greatest pressure from population growth), and by comparing agrarian conditions in these areas with those in the less densely populated districts. This aspect of the study is here confined to Tongatapu and the Ha'apai Group (excluding Tofua and Kao), which are made up of islands basically similar in climate, topography and soil.

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[1] This account describes the situation before the current Coconut Replanting Scheme began to have a significant effect on Tongan agriculture.

[p. 60-A]

farming, instancing reductions in the fallow of from 241
four to five years down to two to three years and 182
from three to four years down to one to two years.
Furthermore, in Ha'apai the fallowed land is more 241
likely to include scattered crops of cassava or taro,
for some farmers have a type of combined cropping 244
and fallow period in which the grasses and other 182
herbaceous plants of the fallow regrowth are left
unweeded around the crop, except when part of
the crop is harvested and replanted. Farmers claim
that both the fallow growth and the cassava help
to restore the fertility of the soil, and that when the
plot is finally cleared and harvested, after perhaps
two years, it can be planted immediately in yams.
This is a more intensive development of the com- 241
mon practice of leaving some crops on the land after
cultivation of the plot has ceased, for the crops are 182
often replanted while the plot is under bush fallow
growth and cropping continues during the whole
of the fallow period.

In Ha'apai and western Tongatapu land shortage 241
has led to most allotments being completely planted 245 ●
in coconuts, although often with a fairly open spac-
ing of the palms. In the village of Holopeka, for 182
example, only one garden was found in which an
area, no more than an acre, had been left clear of
coconuts.

[p. 61-B]

There are also significant differences in the food 241
crop pattern between areas of high and low population 182
density. In areas of high population density
cassava becomes the staple food crop and yams are 241
less frequently grown, despite the fact that cassava, 182
which was only introduced into Tonga in the nineteenth 244
century, has a low status as a food and yam
is the prestige tuber. With the widespread planting [245]
of coconuts and the shorter fallows which have resulted
from the increasing pressure on the land farmers
complain that there is now less land suitable
for yam growing, and many are unable to afford
the long fallows considered necessary to produce
the right soil conditions for the tuber. Cassava, on
the other hand, is easy to cultivate, is more resistant
to drought than the other staples available, gives
good yields even on heavily cropped soils, and does
not require a lengthy fallow. In Ha'apai it is not
unusual to find plots which have been cropped with
cassava for four or five years in succession. Dryland
varieties of taro have also increased in popularity
because they can be replanted several times, and
like cassava were introduced into Tonga only in
the nineteenth century.

The reaction to population growth has therefore 241
involved a reduction in the fallow period, a lengthen- 182
245

[p. 61-C]

ing of the cropping period,[1] a change in the food 241 crop pattern, and a complete areal merging of the 182 bush fallow food cropping system and coconut [245] growing. In some districts the agricultural system is now quite intensive by shifting cultivation standards, [161] with a cropping period/fallow period ratio [162] of about 1:1, and supports population densities of 500 to 600 persons per square mile (cf. Nye & Greenland, 1960, p. 128). However, despite the probable doubling in the intensity of cropping over the last three or four decades there has been no change in the most important element in the system, the technique of maintaining soil fertility. The vast majority of Tongan farmers still depend on a bush fallow, and while fertilizers are increasingly being used for some cash crops this is mostly in central and eastern Tongatapu, where the major commercial banana growers are concentrated, rather than in more densely populated and more intensively cultivated western Tongatapu or Ha'apai. [242] Fertilizers are not used for subsistence crops, neither have other techniques such as planted fallows, composting, manuring or crop rotations been adopted. The agricultural system remains a fairly simple one, and the unsatisfactory features described in the previous section remain.

Two broad explanations for this lack of change in agricultural techniques can be offered. In the first place, it is possible that under Tongan conditions such improvements are not yet necessary. The soils, being derived from recent volcanic ma- 241 terials and not subject to intensive leaching in Ha'- 182 apai and Tongatapu, are of high inherent fertility. 134 While the increased intensity of cropping appears to have resulted in a moderate decline in fertility status, it is possible that yields have been maintained by the adoption of new crops, particularly cassava. Furthermore, Nye and Greenland (1960, pp. 123, 129) point out that under a bush fallowing system it is possible to crop at varying levels of intensity and fertility without catastrophic consequences to the soil, and that up to a limit decreases in yields resulting from an increase in the intensity of cropp-

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[1] According to Nye and Greenland (1960, p. 123) the general response of shifting cultivators to population increase is to change only the fallow period.

creases in population, resulting in say a doubling 241
in the intensity of cropping, may therefore not bring
about significant changes in agricultural techniques, 182
even when quite high levels of intensity are reached.
Thirdly, an imbalance between the rate of increase [171]
in the intensity of cropping and the rate of agricultural
change may also be expected in areas experiencing
rapid population growth, and where farmers
have little knowledge of innovations which
could be adopted, a situation which applies in other
parts of the Pacific besides Tonga.

Probably the major limitation on the usefulness 241
of Boserup's thesis under present Tongan conditions, 182
however, is the fact that population growth
is only one factor influencing agricultural change, 178
for the increasing commercialization of Tongan
life has affected the whole of the agricultural system.
Involvement in cash cropping has helped to encourage [245] ●
the adoption of food crops which require
less labour, and has added to the pressure on the
bush-fallow system through the increased planting
of coconuts, bananas and other crops.[1]

The current Coconut Replanting Scheme appears 245
likely to modify further the food cropping system. 241
Firstly, the increased density of palms resulting
from new planting, and the restriction on cropping
around each palm reduces the area available for
other crops. Secondly, the need to keep down the
bush growth around the new palms and to avoid
any burning which would damage them places severe
restrictions on the practices of bush fallowing and
slashing and burning. Thirdly, if the Scheme's aim
of high productivity is to be achieved and the maximum
benefit gained from the selected seed nuts the
continued use of fertilizers is essential and is being
strongly encouraged. The eventual replacement 000
of the bush fallow as the technique for maintaining
soil fertility in Tonga may therefore be as much a
result of the requirements of commercial agricul-

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[1] In times of good export prices farmers buy much of their food and subsistence cropping declines.

426 423 are not reluctant to ask for help from their *famili;* one may *kole* (ask)
621 foods, money, land use for cultivating or housing, and so forth. And one
612 who is asked for something by one's *famili* would not refuse it. In case
[241] they borrow a portion of *api tukuhau* of their *famili,* they can usually
plant and harvest any crop they like. The only exception is that the
[245] borrower has no right to get the coconuts from trees already planted. The
[434] coconuts are the chief source of the cash income for the villagers. When
[427] I asked them "What do you pay for the use of the land?" a common
answer to this question is that he (she) is my *famili,* which suggests their
idea that they do not have to pay to their *famili.*

Prohibition of Marriage

612 Marriage prohibition extends bilaterally towards the farthest relation-
582 ship. If two persons recognise themselves as belonging to the same *famili,*
even if their actual relationship may not be traceable, they must not
marry. A man and woman in the same generation in the same *famili*
stand as brother and sister; the former should respect and protect the
588 latter. But in a different village, I know of a couple consisting of a man
and his father's (classificatory?) sister's son's daughter. The story about their marriage is as follows. They had lived in the same village and the boy fell in love with her. Every time he came to see the girl, her parents suspecting their immoral love, sent him away. But one day they ran away to Nuku'alofa to get married. After they came back, the bridegroom and his father visited his wife's parents, taking with them food which had been cooked in an *umu.* Then on the evening of the same day, her mother brought bark cloth and mats to their house for the bridal bed. Now, they are apparently not blamed either by their parents or by the villagers because of the run-away marriage, and her mother was not ashamed to tell me the story. Anyway this remains an exceptional case.

612 *Famili* functions in a field of co-operation and marriage and pro-
hibition. On the other hand a *famili* organisation does not necessarily
operate at all since the group for co-operation need not extend beyond
the household. A person needing another's help, may ask the members
[571] of his *famili* individually. In short, in the Tongan way, more emphasis
is put on the interpersonal, individual relationship than on the group
relationship. The next chapters will report the kinship behaviour centring
upon the relationship between individuals.

V The Interpersonal Relationship

Kinship Terminology

601 The terminology of Tongan kinship system has already been precisely
114 described by Gifford, I will touch on some variations from his statement.
He wrote about *tamai* that all male and female relatives of the father and in his generation are said to be called fathers.(15) But so far as I could know, this usage of *tamai* is not so extensive today. It includes the father and the father's brothers in classificatory sense, but not female relations of the father. In the same way, I am not certain if *fa'e* includes

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15. Gifford 1929: 28.

592 take care of (tauhi) them (the old couple)".

511
597 Besides expenditures for everyday material needs, a
592 household must have the cash for periodic outlays to pay
511 members' expenses such as income taxes, the annual poll
434 tax on every male over the age of fifteen, church contributions, and schooling expenses for the children, as
well as to buy store-bought goods such as clothing and
[454] fabric, households utensils, and other implements. Such
purchases and expenditures generally require relatively
large cash outlays that are seldom provided for through
systematic savings. Instead, members of the household
make a special effort to assemble the money shortly
[655] before it is needed. Men collect coconuts to make copra,
[432] or else sell the undried coconuts directly to the Tonga
[462] Copra Board, while women prepare handicrafts for sale
[245] to tourists (especially the tourists who flood in on the
periodic one-day stopovers of cruise ships that visit
[245] Tonga). There is noticably more copra-making activity
and also a particularly well-stocked handicrafts bazaar
in the weeks preceding a new school term, when money is
needed for books, uniforms, and school fees. Usually,
people try to make more money than is needed for the
major outlay at hand. What is left is doled out to provide
cash for everyday needs until another major effort is made.

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511
476
621 Finally, a household must have the means for its

000 would be more likely to succeed on government than on noble estates,
245 and only, of course, in areas where land is available for lease. There is
474 evidence in Tongatapu that some banana-producing cooperatives have
achieved success by using vacant land and employing tractors.

166 A third alternative for landless men is migration, and the 1966 census shows in a number of ways that "... the Tongan population has become mobile, both internally and externally ... the drift of young people from the atolls of Ha'apai especially and rural areas of Tongatapu to Nuku'alofa is probably indicative of this trend" (p. 11).

361 Tonga now has thirteen towns and villages each with a population of
more than one thousand people; nine of these are situated on Tongatapu
island whereas the Ha'apai and Vava'u groups contain only two each.
361 These thirteen towns and villages showed a combined percentage increase
161 of population of 48.3% during the intercensal period, although the two
369 Ha'apai towns combined actually lost population over this period.
Population growth in the nine Tongatapu towns and villages ranged
from 34.0% to nearly 357.0% (Haveluloto) for the decade from 1956;
Nuku'alofa and suburbs (historically three villages) increased over the
same period by 6,483 persons (by 70.0%) to a total of 15,685.

162 Nearly 32.0% of all persons over sixteen living in Tongatapu on the
night of the census were born in other parts of the Kingdom, with 14.4%
361 deriving from Ha'apai and 11.4% from the Vava'u group. Some of these
166 people living away from the place where they were born were undoubtedly
students and temporary residents from the northern islands, but differential
rates of increase for Tongatapu (53.2% during the intercensal period) and
the Ha'apai group (6.78%) suggest that there is a higher rate of internal
migration than could be explained simply by students and visitors. Walsh
has described the process whereby temporary immigrants become permanent residents.[12]

Some imbalance between the sexes is apparent in Tongatapu's excess of males "born elsewhere" over females "born elsewhere". Supporting the argument that many of Tongatapu's immigrants derive from Ha'apai, is the evidence that there is a shortage of males in that group; there are only 491 males per 1,000 persons in the Ha'apai district—the only deviation from the national pattern of male predominance.

* * *

582 The average age for marriage has increased since 1956 when over 3.0% of all men and over 9.0% of all women were married in the fifteen to nineteen age-group. The 1966 returns indicate that only about 1.0% of the total male population and just over 7.0% of the total female population in this cohort were married. It is possible that some of the reasons for this delay in marriage are the shortage of land in rural areas, the excess of men in urban areas, the increasing cost of traditional weddings, the shortage of and desire for wage employment and money, and the enormous advantage post-primary education gives to obtaining wage employment.

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[12] Walsh 1967:14.

is of a steep rugged coral rock nine or ten feet high, except the two 133
sandy beaches already mentioned, which have a reef of rock extended
from across their entrance to the shore and defends them from the
sea. They make excellent harbours for boats but it is difficult to get
in at low water, though at that time it is easy landing on the rocky
shore without if the weather is moderate. On the SE side which the [132]
Master examin'd is a fine sandy beach with good anchoring &
landing, but it is expos'd to the ESE wind which blows almost
constantly and sometimes pretty fresh, from whence it can scarcely
be preferable to our anchoring place, the best part of which seems just
to the W^tward of the largest sandy beach, as appear'd from the
Discovery lying foul by being a little the other way. In the centre of
the isle is a large Salt lake about a mile & a half across, round which
the land rises like a bank with a gradual ascent; but we could not see
any communication it has with the sea, though from the low land
that runs across to it from the largest sandy Beach and the sandy soil
it would appear it may have once communicated that way. There is
another lake or pond, but much smaller, a little way from the shore
on the left hand of the sandy beach from which we took our water,
and though brackish may if taken up after rain (a great deal of which
luckily happened just before our arrival) answer the purposes of a
ship sufficiently. The soil on the rising parts of the island & especially [134]
towards the sea is of a reddish clayey disposition or a black loose
mould, but there is no other water than the pool already mentioned, [312]
except in some small holes dug by the natives near the last which
afford much better water than the pool itself.

It is very well cultivated except in a few places, and there are some 241
others which appear to lye waste but are only left to recover the
strength exhausted by constant culture, for we have seen them
frequently breaking in these spots to plant again. The plantations 245
consist chiefly of Yams and plantanes, many of which are very 417
extensive and often inclos'd with neat fences of reed dispos'd obliquely across each other about six feet high. Within these are 244
frequently seen other fences of less compass which surround the
houses of the principal people, but for the most part these are found

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can compare high land, and shall therefore say that it is the next in degree whether with respect to the whole body of land being high or its being interspers'd with high hills. Very high or mountainous land cannot be easily comprehended in a single definition, but may be understood by its always exceeding the other & adding some particular description of its height.

It should be observd that the criterion of low land mention'd above can hardly be applied to Annamooka and some of the isles about it, but I have considerd them as low merely to avoid confusion, as they cannot be admitted to the rank of those of a moderate height which we have yet seen, as Wateeoo & Mang'ya.

A [of Nomuka--Analyst]

245 in the open plantane fields. The bread fruit and Cocoa nut trees are
[417 interspers'd with little order though chiefly near their habitations,
and the other parts of the island, especially towards the sea and about
[244 the sides of the lake are coverd with trees and bushes of a most
luxuriant growth, the last place having a great many mangroves &
the first a vast number of the Fait'anoo trees already mentioned.
133 There seems to be no rock or stones of any kind about the island that
is not coral, except in one place to the right of the sandy beach which
is the highest part of it, where there is a rock twenty or thirty feet
high of a calcareous stone of a yellowish colour and a very close hard
texture, but even about this place are large pieces of the same coral
rock that composes the shore.

648 We liv'd on the most friendly terms with the natives while we
remain'd here, and obtain'd a much larger supply of refreshment
609 than could have been expected from so small a place, but it should be
[439] consider'd that all the small islands around it furnish'd their Quota,
[342] and the strangers that brought their hogs and other things were
oblig'd to live in temporary huts which they erected or lay them-
[136] selves down behind bushes or ferns. Besides walking frequently in the
country, which we were permitted to do without any interruption,
we sometimes amus'd ourselves in shooting wild ducks not unlike the
Widgeon[1] which are very numerous upon the salt lake and the other
648 pool. In these excursions we found the people had often deserted their
houses to come down to the trading place without entertaining any
609 suspicion that strangers rambling about would take away or destroy
439 any thing about them, but though in these cases it might be suppos'd
161 a great part of the inhabitants were sometimes collected at the beach
162 it was impossible to form any true computation of their numbers, as
the continual resort of strangers from other places mixing with them
might easily mislead one. However as there was never to appearance
above a thousand seen at one time it would perhaps be sufficient to
allow double that number for the whole island.

114 We steerd about NNW towards Kȧô and Toofȯȧ in our way to
Hapaee,[2] an island which Fee'nou said was of a considerable extent,
634 where we could be supply'd plentifully with every refreshment in the
[648] easiest manner. He engag'd to go to this place with us himself and
seem'd to have some interest in it, for he express'd a good deal of
aversion to the Captains intention of going to Amsterdam which he
133 mention'd to him. Although they made us understand that Hapaee
lay rather to the NE of Anna'mooka, we were obligd to take this route
114 because there is a cluster of islands lying between Annamooka &

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[1] *Anas superciliosa.*

[2] Ha'apai.

A [Nomuka--Analyst]

Poulaho to be King of Amsterdam & the other isles but seem'd to 634
insist very much upon it, perhaps from a fear of offending the other 648
when he should hear of his former presumption.

The inhabitants have been very busy in cultivating while we were 643
absent for they have made several large Plantane fields in places that 245
were waste at first. We observ'd here as well as at Kotoo a good many
of the small hillocks where the Yams are planted strew'd with a little 244
white sand, which they say are those intended for the use of the chief. 565
The Melons which the Captⁿ sow'd here have come up but are mostly
eat by small insects & some of the Pine apples left with Toobou seem 137
to be in a thriving state. 177

SATURDAY 7th. The wind ENE. Fresh breezes with fine clear weather. 241
In the forenoon Poulaho came from Kotoo and we could at once see 132
his superiority to Feenou on meeting him, for the last plac'd himself
down in the circle that sat before Poulaho as an indifferent person. 643
He seem'd at first rather abash'd as some of us were present who had 634
been us'd to see him as a different person, but he soon recover'd
himself & both he and Poulaho went on board with the Captain. He [576]
behav'd there much as any of the others that attended Poulaho, [644]
saluting his foot with his head and hands and could not ther[e] eat [576]
nor drink before him.

A few Canoes came off to the ship but we had less trade on shore
than yesterday as most of the people went away when Poulaho 439
landed. 643

Some of the Indians stole three glasses belonging to the Astronomical Quadrant while Mʳ King was observing on the beach, but 648
they were soon recoverd by applying to Feenou who had been very 634
usefull to us before when things were stole both here and at Ha'paee.

SUNDAY 8th. The wind ENE and NE. Moderate breezes but at night 132
rather gentle. The weather fine. A moderate sea. Between eight and
nine in the morning we weigh'd and left Annamooka steering sbw 114
for the island Amsterdam. The islands to the SE of Annamooka which 133
we had on our left are first Mango'eeke, Mango, Tonoo'maia,
Ko'noogoo and Falla'fa'jeea.[1] There is also a very small one off 103
Kon'oogoo call'd Gefoo'ganna[2] from which runs a large shoal nam'd
Ko'foonga'lillo.[3] In the evening between five and six we saw two
islets or rocks bearing W about four leagues, the Noermost call'd
Hoonga ha'paee and the other Hoonga'tonga.[4] The first has only five 162

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[1] Kelefesia.

[2] Kefikana, a conspicuous white rock.

[3] I cannot identify this shoal.

[4] Hunga Ha'apai and Hunga Tonga.

55: Anderson D,T-5 (1777) 1967 OU9 Tonga OU9

the large end against a stone fix'd in the ground for that purpose, and 351
the other being push'd against the door serves as a strong bar, which 342
makes it as necessary to rap here at the door as at a gate in England
before you can enter an inclosure. In a great many of them there is a [417]
smaller inclosure within, this also often with a door, where the house
of the principal person is immediately plac'd, and near it or very
often in the outer one houses of an inferior sort for servants and
dependents. There are sometimes several little places again within
this that have fences and houses, but communicate freely with each [247]
other, and in most there is commonly a pretty spot of short grass,
though of no regular figure, before them with sweet smelling shrubs
call'd Ma'eele[1] and Hooe[2] planted up and down and some other trees
that produce beautifull flowers. The outer inclosure has commonly
such things as they often want planted in them, as Cocoa nut trees [245]
or some plantanes and bread fruit, but no considerable plantations of
Plantanes or Yams.

Beyond this a mile or two we generally found the Plantations more 311
extensive but open, and still farther on a great quantity of uncultivated
land coverd with grass as high as the Knee. Our guides said if
we advanc'd that way we should still find a waste uncultivated
country, or as they call it Vàò,[3] but they probably did it only to save
themselves a little fatigue, for some miles beyond this the land seem'd
to rise a little higher and had a great many Cocoa trees, both signs of
its being cultivated. It could also be observ'd that even in this place
the soil was good, and it is probable many of the spots only lay fallow,
for we saw two or three large plantane fields that had lately been
broke in from such ground. It is remarkable that when on the highest 193
part, which is at least a hundred feet above the level of the sea, we
often found the same coral rock which is found at the shore, projecting
above the surface in the paths; and in many places where there
were large breaches with a small quantity of stinking water at the
bottom, it was always in the solid coral shatterd or seperated as it
were by violence.

At one place we fell in with a house where they were manufacturing 281
their cloth, which though extensive in itself is a very simple
operation. They take the slender stalks (or trunks) of the papper [248]
mulberry plant, which they cultivate for that purpose and seldom
grows more than six or seven feet in height or four fingers in thickness, [237]
from which they strip the bark and scrape off the outer rind with

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[1] Maile, *Alyxia stellata*, a shrub with fragrant long slender stems, abundant small leaves and dark red berries, much used for wreaths. [824]

[2] Hoi, *Dioscorea bulbifera*, one of the yams, with small flowers in spike-like clusters.

[3] *vao*, land in its natural uncultivated state. Anderson is very accurate.

continuation of the mourning ceremony by way of condolance, for 765
upon enquiring who it was done for they said it was a chief who had
died at Va'vaoo some time ago, that they had practic'd it ever since
and would do it for a considerable time longer.

In the evening we had a pig dress'd as the hog with Yams and 648
Cocoa nuts brought for supper, and Futtafaihe finding we did not
like the scruples they had made before to accept of any part of the 574
entertainment, ask'd us immediately to share it & give it to whom we 264
pleas'd. When supper was over abundance of cloth was brought for 262
us to sleep in but we were a good deal disturb'd by an odd custom, at
least amongst the better people, of being beat while they are asleep. 519
Two women sat by Futtafaihe and perform'd this operation, which is
call'd Tooge Tooge,[1] by beating briskly on his body and legs with
both fists as if on a drum till he fell asleep, and continued it the
whole night with some short intervals. After being asleep they abate
a little in the strength & quickness of the beating, but resume it if
the person is likely to wake, and towards the morning we found the
women relievd each other by turns & went to sleep. In any other
country it would be suppos'd such a practice would put an end to all
rest, but here it certainly acts as an opiate and is a strong proof of
what habit may effect. The noise made by this was however not the 521
only thing that prevented our resting, for the people who slept in the
house not only convers'd amongst each other frequently as in the 264
day but all got up in the midst of the night & made a proper meal of 262
fish and yams, which were brought to them by a person who seem'd
to know very well the appointed time for such things.

[JULY 1777]

TUESDAY JULY 1st. The wind N and NNW. Gentle breezes with fine 132
weather. In the morning we set out with Futtafaihe and walk'd down
the east side of the Bay to the point that is opposite Hoolaiva. The 114
country all along this place is very well cultivated but in general not 648
so much inclosd as at the bottom, and amongst many others that are
very large we pass'd one plantane field at least a mile long which was 311
in excellent order, every tree growing with great vigour and not a 245
bit of grass to be seen. We found that in travelling Futtafaihe
excercis'd a power, though by no means wantonly, which pointed 643
out the great authority of some of the principal men, or is perhaps
only annex'd to the royal family; for he sent to one place for fish, to
another for yams &c and so on at other places, which were always
brought with the greatest readiness as if he had been absolute master

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[1] *tukituki.*

55: Anderson D,T-5 (1777) 1967 OU9 Tonga OU9

[1777]

134 height, and when broken off appears sometimes of a reddish though
oftener of a brownish yellow colour & pretty stiff consistence. Where
[137] the shore is low the soil is commonly sandy or rather composd of
[241] triturated coral, which however yields bushes with great luxuriance
and is sometimes planted not unsuccessfully by the natives.

Of cultivated fruits the principal are Plantanes of which they have
241 eighteen different sorts or varieties, Bread fruit, Jambos,[1] a sort of
245 plumb mention'd in Captⁿ Cooks account of Otaheite call'd E'eevee,[2]
and vast numbers of Shaddocks[3] which however are found as
241 often in a natural state as planted. The roots are yams, of which are
two sorts, one black & so large that they often weigh twenty and
244 thirty pound,[4] the other white and long seldom weighing a pound;[5] a
large root call'd Kappe,[6] one not unlike our white Potatoes call'd
Ma'whaha,[7] the Talo or Coccos[8] of other places and another nam'd
241 Jeejee.[9] Besides vast numbers of Cocoa nut trees they have three other
sorts of palms two of which are very scarce. One of them is call'd
245 Beeoo, which grows almost as high as the Cocoa tree, has very large
leaves plaited like a fan, and clusters or bunches of globular nuts not
larger than a small pistol ball growing amongst the branches with a
very hard kernel which is sometimes ate.[10] The other is a kind of
Cabbage tree not distinguishable from the Cocoa but by being rather
thicker and having its leaves more ragged. It has a Cabbage three or
four feet long, at the top of which are the leaves and at the bottom the
fruit, which is scarcely two inches long, resembling an oblong cocoa
nut with an insipid tenacious kernel call'd by the natives Neeoo
[264] goola or red cocoa nut, as it assumes a reddish cast when ripe.[11] The
third sort is calld Ongo ongo and much commoner, being generally
found planted about their burying places. It seldom grows higher
than five feet though sometimes to eight, and has a vast number of
oval compress'd nuts as large as a pippin sticking immediately to the
137 trunk amongst the leaves which are not ate.[12] There is plenty of
excellent sugar Cane which is cultivated, Gourds, Bamboo, Tur-
114 meric, and a species of fig about the size of a small cherry calld Matte,
824 which though wild is sometimes ate;[13] but the Catalogue of unculti-
241 vated plants is too large to be ennumerated here, especially as the
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[1] *Eugenia malaccensis.*

[2] Vi, *Spondias dulcis.*

[3] *Citrus decumana.*

[4] *Dioscorea alata*, though the tubers are generally brown on the outside rather than black. They sometimes grow to an enormous size, 6 to 8 feet long, and weigh much more than 30 lb.

[5] ? *Dioscorea bulbifera*, the wild yam.

[6] The Giant Taro, *Alocasia macrorrhyza.*

[7] Mahoa'a, *Tacca leontopetaloides.*

[8] Taro, *Colocasia antiquorum.*

[9] Si, *Cordyline terminalis.*

[10] Piu, *Pritchardia pacifica.*

[11] It was a sort of coconut: Niu kula, *Cocos nucifera* ssp.

[12] It is called Longo-longo by the modern Tongans: *Cycas circinalis.*

[13] Modern Masi, *Ficus tinctoria.*

301 cylindrical bits of ivory[1] about three inches long, introduc'd at one
237 hole and brought out at the other, or bits of reed of the same size fill'd
304 with a yellow pigment which seems to be a fine powder of turmeric,
with which the women sometimes rub themselves all over in the same
302 manner that our ladys use their dry rouge upon the cheeks. Nothing
seems to give them greater pleasure than personal cleanliness, to
515 procure which they frequently bathe in the ponds which seem to
serve no other purpose. They prefer these to the sea, though most of
them stink intolerably, because the water is a little fresher and they
are so sensible that salt water hurts their skin that when necessity
obliges them to bathe in the sea they have commonly some Cocoa nut
302 shells of fresher water pourd over them to wash it off. They are
immoderately fond of Cocoa nut oil for the same reason, a great
quantity of which they not only pour upon their head and shoulders
but rub the body from head to foot briskly with a smaller quantity,
and (unless to those who have seen this practice) it is not easy to
conceive the different appearance and advantage they seem to
[565] receive from undergoing these different trimmings. This oil however
[296] is an article not to be procur'd by every one, and the inferior sort of
people doubtless appear less smooth for want of that and more
frequent shifting of their cloth, as it is no uncommon thing to see
them wash the last though its texture would at first make us think
that could not be done.

461 Their domestic life is of that middle kind which I believe the most
sensible part of mankind always desire, which is to say it is neither so
laborious as to be disagreeable nor so vacant as to suffer them to
degenerate into indolence. Nature has done so much for their
country that the first can hardly occur and their disposition seems to
be a pretty good bar to the last. This happy combination of circumstances
is such that their necessary labour seems to yield in its turn to
their recreations, in such a manner that the last are never interrupted
by the thoughts of being oblig'd to recur to the first till
462 satiety makes them wish for such a transition. The employment of the
women is of the easy kind and for the most part such as may be done
462 in the house. The manufacturing their cloth as already describ'd is
wholly consign'd to their care, and next to that fabricating their matts
285 seems to be of the greatest consequence. Of these they have seven or
eight different sorts for the purposes of wearing or sleeping on and
[824] many are merely ornamental. The last are chiefly made from the
[245] tough membranous part of the stock of the plantane tree, those they
[248] wear from the Pandanus, cultivated for that purpose and never

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[1] Whale tooth.

sufferd to shoot into a trunk, and the coarser sort which they sleep 462
upon from a plant call'd E'varra.[1] There are many other articles of
less note that employ their spare time, as combs of which they make 285
vast numbers, little baskets made of the same substance as the matts [824]
and others of the fibrous Cocoa nut husk, either plain or interwoven [245]
with small beads, but all made with such neatness and taste in the [248]
disposition of the different varietys, which are very numerous, that a
stranger cannot help looking with pleasure at their assiduity and
dexterity. Every person knows the beautifull character that Solomon 462
has drawn of an industrious women and the happy consequences
that attend it, and we may almost venture to say that Solomon in
that character has included a true picture of all the women of Tonga.
The province alloted to the men is as might be expected far more
laborious and extensive than that of the women. Agriculture, Architecture, [241]
Boat building, Fishing and other things that relate to Navigation [341]
are the objects of their care. I would not wish to refer to any [396]
thing prior to the date of this voyage to illustrate any circumstance [226]
by, when I can avoid it, as it would be interweaving subjects that [502]
ought to be seperate unless every person knew them as well as myself,
but I cannot help relating here an observation which may have been 562
made before, though not to my knowledge, which is that in all the
places I have visited in these seas the degree of civilization that has 171
taken place amongst them may be known by the attention they pay
to the fair sex. Those in a very barbarous state treat their women
with such a degree of rudeness or rather brutality and at the same
time indifference that they seem to think them not so much intended
as a companion, or to be upon the same scale with themselves, as a
set of beings every way inferior to them and only fit for such mean
offices as they would not stoop to. On the contrary as civilization has
advanc'd we find them not only eas'd of those laborious employments
which their natural delicacy of frame requires, but treated
with that respect to which they are often more justly entitled than
their lordly masters, and have even a great sway in the management
of affairs. Cultivated roots and fruits being their principal support 241
requires their constant attention to Agriculture, which they pursue
very diligently and seem to have brought to as much perfection
almost as circumstances will admitt of. The land about Mooa though 241
so well planted is scarcely equal to that part of the island where Capt
Cook anchor'd in 1773, and from Mooa to the NE point which is all 311
the places we have seen it is tolerable, from whence one might suppose,
if the unseen parts are in the same proportion, that two thirds

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[1] *fala* was the word for sleeping-mat, not for a plant. The pandanus was called *fa*.

241 of the island is in the highest state of cultivation. The large extent of
[311] the Plantane fields was taken notice of already, and the same may be
said of the Yams, these two together being at least as ten to one to all
[412] the other articles. In planting both these it does not appear they turn
over the ground as we do, but in a field that has lain waste and is
coverd with grass they dig small holes for their reception, and afterwards
root up the grass with a flat narrow wooden instrument call'd
Hōōò,[1] which in this hot country is quickly depriv'd of its vegetating
power and soon rotting becomes a good manure. They are planted
in rows by a line such as our Gardiners use, in such a manner that
which ever way you look the rows present themselves regular and
compleat. The Plantanes are usually three paces asunder, the Yams
two and the Jeejees one. The first are shoots from the root of the old
tree, which when weak they often defend with a sort of basketing laid
over them, and the Yam tendrils at first shooting up are frequently
245 supported on short bits of sticks. The Cocoa nuts and bread fruit trees
241 are scatterd about without any order and seem to give them no
trouble after they have attaind a certain heighth. The same may be
said of another large tree which produces great numbers of a large
roundish compress'd nut call'd 'Eēfee,[2] and a smaller tree that bears
a rounded oval nut two inches long with two or three triangular
kernels, tough and insipid, call'd Mabba,[3] most frequently planted
near their houses. The Kappe is commonly regular[l]y planted and
in pretty large spots, but the Ma'whaha is interspers'd amongst other
things, as the Jeejee or Yams, the last of which I have frequently seen
in the interspaces of the Plantane trees at their common distance.
241 Sugar cane is commonly in small spots crowded closely together, and
248 the Mulberry of which the cloth is made, though without order, has
[249] sufficient room allowd it and is kept very clean. The only other plant
they cultivate for their manufactures is the Pandanus which is
commonly planted in a row close together at the sides of the other
fields, and they consider it is a thing so distinct in this state that they
have a different name for it,[4] a proof that they are very sensible of the
great changes brought about by cultivation. Whether the same remark
may be applied to the Mulberry I am not certain, for it seems
doutfull if ever they knew it in any other than its present cultivated
one, as it never flowers; at least there was none of the old trees from
whence they could propagate it seen, wheras the Pandanus is one of
417 the most common in the country. Their fences should be considerd
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[1] *kuo.*

[2] Ifi, *Inocarpus edulis.*

[3] Mapa, *Diospyros lateriflora* or *D. ellipticifolia.*

[4] The Tongan vocabulary at the end of the third volume of the printed *Voyage* gives one of the meanings of 'Keeai' [*kie*] as 'the cultivated Pandanus'.

423
427 villager finds land borrowing for cash production an increasing
178 problem. Land cannot be borrowed for planting coconuts, which
241 rank about equal with bananas as a cash crop, and palms on an
allotment are the property of the landholder, regardless of who
423 planted them. A common practice for those without land is to obtain
● 245 permission to collect one or two cartloads of coconuts for copra-
427 making from the allotment of a relative or close friend, and for this no return is given. Another arrangement found, especially between non-relatives and where the landholder is absent, is for the cash received for the copra to be shared half-and-half.

423 The effect of landholding on cash-crop incomes is shown in
511 Table 7.3, which presents data from the household survey of four
Tongatapu villages mentioned in an earlier section. The inability of
592 the social system and its customary obligations to even out inequalities in landholding is shown in the fact that households without land had only half the income per capita or per adult male of households with a full-sized allotment. On the other hand households with two allotments did not have higher incomes per head than single-allotment households, for although total income was higher these households were larger and had more adult males.*

423 The main conclusion that can be drawn from this discussion is
182 that the present land-tenure system, although it cannot provide land for every household, is still able to cope with the subsistence needs
178 of the people, but is less able to cope with the rising demand for land
241 for cash cropping. The increasing difficulty of borrowing land for growing cash crops and the trend towards the payment of rentals for land both point to pressure within the system. This pressure, however, is as much the result of the growing commercialization of Tongan agriculture as of population increase alone.

THE AGRICULTURAL SYSTEM

241 Tongan agriculture is based on a bush fallowing system† for the cultivation of tubers, the main food crops being yams, taro, cassava, sweet potato, bananas and plantains. After clearing and burning, a plot is cropped for two to about five years and then bush fallowed for

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[128] * The number of households in the survey with allotments smaller than 2·7 ha was too few for useful analysis.

† The term 'bush fallowing' is here used to describe a form of shifting cultivation in which the fallow period is short.

from one to ten or more years, depending on population density. 241
Of the two main cash crops bananas are often incorporated into this 241
bush fallow system, being planted as part of the cropping sequence 245
and yielding for only a couple of years before the land returns to
bush; but during the last few years they have increasingly been
grown in separate plantations, and chemical fertilizers are now being
used both to improve yields and to extend the life of the plot. The
other main cash crop, coconuts, is unevenly scattered over all or
part of each allotment, with the food-crop gardens being rotated
amongst them. The effect of population density on this system will 121
be examined from two perspectives, the ecological and the economic.

An ecological assessment

In Ha'apai, where the agricultural system is under the greatest 241
pressure from high population density, the cropping period is now 182
usually from three to five years, compared with the two or three
years common elsewhere, while the fallow period is generally from
only one to three or four years compared with three to five years
elsewhere. Many farmers in Ha'apai are using shorter fallows than
when they began farming, a common change reported amongst older
men being a reduction to half the earlier fallow length. The food-crop
pattern has also changed with the increase in population density.
In areas of high density, cassava has become the staple food crop [244]
while yams, the most preferred tuber for eating, are now much less
frequently grown. Cassava gives good yields even on heavily-cropped
soils and does not require a lengthy fallow, and also yields more per
man-hour of labour than the other food crops.

The response of Tongan farmers to population growth has therefore been to reduce fallow periods, lengthen cropping periods and
alter the food-crop pattern, and these changes are most pronounced
in Ha'apai. There the agricultural system is now fairly intensive by [161]
the standards of shifting cultivation, with a cropping period/fallow
period ratio of around 1 : 1, and supports population densities of up
to about $280/km^2$ (cf. Nye and Greenland, 1960, 128). Yet despite
the probable doubling in the intensity of cropping over the last 30
to 40 years there has been no change in the bush fallow technique of
maintaining soil fertility, and one might therefore expect to find
symptoms of ecological stress within the system.

An examination of possible areas of stress, however, suggests the
existence of as yet only minor problems. There has been some [137]

166 The pattern of internal migration, however, shows more sensitive
182 response to population pressure, particularly in Ha'apai. The basic
reason for migration in Tonga is the lack of opportunities to earn
166 money in the outer islands as compared with Tongatapu, but the
182 influence of land shortage is indicated by the fact that, within
161 Ha'apai, population growth between 1956 and 1966 in each island
162 tended to be inversely proportional to the 1956 population density
[311] (Fig. 7.2). The three islands which lie furthest from the general trend
(circled in Fig. 7.2) all have residents who utilize land on the nearby
high island of Tofua, and their effective population densities are
182 therefore lower than those shown. It may be hypothesized that the
higher the population density the harder it is for men, particularly
511 those without their own allotments, to achieve a satisfactory cash-
245 crop income, and in Ha'apai this problem is made greater by the
464 fact that until recently cash cropping was largely restricted to
coconuts, while opportunities for wage employment in the group
166 have always been very limited. Of 20 cases of migration collected in
Holopeka (Ha'apai), for instance, 18 were men without allotments,
182 and 11 of these had left their village at least partly in the hope of
obtaining land. That landlessness is not the only reason for migra-
tion, however, is shown in the fact noted earlier that those who had
left Ha'afeva (Ha'apai) in 1966 included nearly half the men who
[731] already held land on the island. Employment following education
on the main island, dissatisfaction with village life, a desire to take
advantage of the better opportunities to earn money in Tongatapu
or to ensure a better education for one's children are all important
reasons for movement, while in Vava'u the damage caused to the
economy by the 1961 hurricane seems to have been the major
determinant of migration from that group in the early 1960s.
Nevertheless, the pattern of migration from Ha'apai outlined earlier
does demonstrate the significance of land shortage as a factor, and
suggests that population pressure is sufficiently felt by many Tongans
to stimulate them to leave their home village.

CONCLUSION

121 In the preceding sections we have examined a number of facets of
182 the man/land system in Tonga. Symptoms of stress or pressure were
found in land problems, the fallow vegetation, the nutrient status of
the soil, cash-crop incomes and internal migration, and these point

121 While the second of the three situations outlined above is a
182 possible explanation of the failure to improve agricultural techniques
241 in Tonga, another type of explanation—that such improvements are
not yet necessary—seems most likely to be correct. As suggested
182 earlier, the soils are of high inherent fertility, and shifting cultivation
241 systems can withstand a good deal of intensification before funda-
mental changes are essential. The adoption of cassava and dryland
[407] varieties of taro, both of which were introduced into Tonga in the
nineteenth century, has helped to maintain yields per man-hour as cropping has been intensified, while the adoption of the metal push-hoe has enabled farmers to cope with the changes in the fallow vegetation. Such adaptations in the agricultural system may well be sufficient at the present level of intensity. The symptoms of population pressure are still mild, and the main pressures felt by Tongans, to judge from the material on land problems and migration, are in
[114] cash cropping rather than in the food-cropping system. Acceptance
[121] of this explanation would thus leave Boserup's thesis in the category
of 'not proven', but probable.

However, the fact that the most significant changes in Tongan agriculture, involving such practices as machine preparation of land and the use of chemical fertilizers, have occurred in Tongatapu amongst farmers heavily engaged in cash cropping rather than amongst the less commercialized farmers in more densely-populated Ha'apai, suggests one major qualification to her argument. While land shortage has undoubtedly been a factor in these changes, for they began about the time when land ceased to be easily obtainable in Tongatapu, they indicate that commercialization is also a stimulus to the adoption of improved techniques. Population pressure, as noted above, is felt mostly in cash cropping rather than in food cropping. The income received from cash cropping makes it feasible to purchase industrial inputs such as fertilizers, while changes in cash cropping have repercussions throughout the agricultural system.
182 The increase in the area planted in cash crops, for instance, intensifies
241 the pressure on the bush fallow system, but where food crops are
intercultivated with a cash crop like bananas, as is frequently the
245 case, the former benefit from the fertilizer used for the latter, thus
making it possible to lengthen the cropping period and reduce the role of the bush fallow. With coconuts, a long-term crop, the need to control bush growth conflicts with the traditional practice of bush fallowing, and the achievement of higher productivity in coconut

plantations will thus require changes in food cropping techniques. 182
At present, therefore, commercialization and population pressure 241
would appear to be working together to stimulate agricultural [245]
improvements in Tonga, and where one or the other is weak the
extent of agricultural advancement is so far limited.

[421 cont.]

000 connected the two parts of the island together, which notwithstanding
its agreeable appearance, seemed to be entirely uninhabited. Captain
Cook gave it the name of Hervey's Iile! in honour of the present earl
of Bristol. A bird which resembled a sand-piper in its flight, and
[422] note, had appeared about the ship, the day before we made this
island, and might be said to have announced its proximity, but though
we observed another of the same sort on the 26th, which actually
settled in the rigging, yet we did not fall in with another island.
We held a westerly course from Hervey's Isle, which lies in 19° 18'
south latitude and 158° 54' west longitude from Greenwich, till the
first of October, when we saw land before us about two o'clock in the
133 afternoon. In four hours time we came within two or three leagues of
175 it, and found it of a moderate height; the hills were covered with
trees, and offered a pleasing, though not magnificent prospect. At
the southwest extremity we observed a small rocky islet, and to the
175 northward a low land of greater extent. From thence we judged, that
[101] the isle before us was the same which Abel Janssen Tasman named
Middleburg Isle, in 1643, and that the other to the north, was that of
Amsterdam, discovered by the same navigator. We lay to all night, and
with day-break [October 2] passed round the S.W. point of Middleburg
175 Isle, and ranged its western coast. There appeared to be some low land
245 at the bottom of the hills, which contained plantations of fine young
137 bananas, whose vivid green leaves contrasted admirably with the
different tints of various shrubberies, and with the brown colour of
175 the coco palms, which seemed to be the effect of winter. [423] The
light was still so faint, that we distinguished several fires glimmering in the bushes, but by degrees we likewise discerned people

! [Sic!--Analyst]

632 87-92) gives a good description of the town and its character.

631 Government reaches out through a system of districts, sub-districts
634 and villages. District and Town Officers act as agents of the govern-
622 ment, and although they are elected to their positions, they have lit-
622 tle or no decision-making powers. Governmental decisions and orders
621 are related to the people through the Town Officer in a village meeting
631 (fono). This system exists side by side with the traditional pattern
565 of rule by nobles. The power of nobles frequently exceeds its legal
178 limits but is accepted by the peasantry. A Tongan writing of what the
result of disobeying a noble would mean to a commoner describes it in
this manner,

> ...he and his family will be sacked from that village and have to start a new life under another noble or chief in another village or island. This happened very often in the past, even now but in a lower degree (Anonymous 1970).

The National Economy

439 The economy of Tonga is based on the cultivation and export of co-
[433] conut products and bananas. Government commodity boards are the only
[245]
[655] legal exporters of these products so that producers must sell to the
government. Other products, primarily agricultural, are exported but
in 1969 totalled less than 10 percent of Tonga's total export (Tu'ipe-
lehake 1969: 4-5). Tables 1 and 2 provide information on Tongan exports
and imports. A

245 Recently both major crops have been threatened by factors seemingly beyond the control of government and growers. Many coconut palms have aged beyond their productive years, and an infestation of palms by the

A.[See pp. 15-17--Analyst]

[TEXT CONTINUED ON PAGE 18]

245 rhinocerous beetle has damaged a large percentage of trees. The banana
crop has recently been infected with a fungus, black leaf streak disease, to such a degree that many of the growers have stopped planting
commercial crops, and in the remaining plantations the yield is insufficient to allow profitable harvest. Damage done by careless packing and
[439] improper storage during shipment is resulting in the dissatisfaction of
importers.

241 The 1966 Census of Tonga shows that 66.6 percent of all adult males
[162] [463] were engaged in agriculture (Fiefia 1968: 28). Table 3 gives a full
breakdown of occupation of Tongan males.[A] Agricultural techniques are a
[177] [178] mixture of the traditional techniques-swiddon agriculture, bush fallow
periods, and hand tools-and modern methods including the use of fertilizers, light machinery and single crop planting. The older techniques
241 are still the more widely used. A friable, well-drained, and easily-
134 worked soil is the predominant type. Maude (1965: 12-18) gives a fairly
detailed discussion of Tongan soils, their fertility, and their geologic origins.

241 Tongan agriculture is subsistence oriented and cash-cropping re-
[656] mains a secondary consideration for most Tongans, with the exception
that law requires the planting and maintenance of a certain number of
464 coconut palms. Wage labor provides income for only a few (Table 3) and
465 wages are low, averaging somewhere between $T1.00 to $T1.75 a day; most
wage labor positions are in the area of services.[1] [B]

A.[See p. 19--Analyst] B.[Footnote appears on p. 122--Analyst]

The Village and the Research Scene

101 The village selected for research is on the main island of the
103 Tonga group, Tonatapu. Its name is Puke (pronounced Pookay, please).
[361] Gifford (1926: 196) in his catalogue of Tongan place names enters Puke
as the gloss of fortress.[A] However, the term has several seemingly unrelated definitions in the Tongan language; the villagers thought the
name referred to a small hill in the village as the term denotes the
[361] small hill above a planted yam. The village is located about 3 miles
[131] west of Nuku'alofa; it is 1/4 mile from the main road going west from
Nuku'alofa and about twice that distance from the lagoon to the north
(See Map 2).

133 The terrain of the village and surrounding lands is flat and low-
361 lying. Village boundaries are easily distinguishable as fallow, and
[241] producing garden plots stop abruptly at the perimeters of the village
compound. For some purposes the village and its population are divided into three geographically defined sections. The sections are the eastern section (*vahe hahake*), the central section (*vahe loto*), and the western section (*vahe hihifo*); the sections are under the leadership of the noble, the church steward, and the town officer, respectively.

361 Within the village are small patches of low-lying bush and many
245 trees have been left standing or planted; most prominent among the latter are the coconut palm (*niu*), breadfruit (*mei*), mangoe (*mango*), and
[824] tje *tava* amd '*ifi* trees. Many of the plants and trees growing within
[262] the village have uses as food, medicine, or decoration.

[278] A.[What Gifford actually says is "the outworks of a fortress". See 4: Gifford, this file p.196--Analyst]

342 quarters of the household head and his wife from the rest of the house. The larger portion of the interior is used for working, receiving guests, kava parties, eating, and as a bedding area for children and other members of the household.

351 Compounds often have small garden plots of decorative or edible plants, and hedges are a common feature around compound borders. Palms. (245) breadfruit trees, mangoe trees, and other large plants with fruits or barks of an edible or medicinal value are left standing in the compound, (462) but all other vegetation is removed. The lawns are cut and swept by the (857) women and children of the household. Pigs, goats, chickens, cows and (231) horses are often picketed or penned within the compound.

Relationships within the Household

592
594 Most Tongans have a preference for living in nuclear family households and this pattern is generally followed. Of the forty-two households in Puke, forty-one are nuclear families, eight of which contain an unmarried relative of the household head or the household head's 592 wife. One household includes three conjugal pairs, but two of the married couples were only recently married and have not yet established independent households. Village households have a mean size of 6.52 persons. (The 1966 Census of Tonga shows a mean household size of 6.9 persons for Tongatapu.)

592
594 A household, then, most frequently consists of a man, his wife, and their real or adopted children. Within his own house a man is tangata 'eiki 'chiefly man', and is the authority of the household.

Presumably, the unintentional introduction of certain weedy species occurred 137
at the same time. A good many cultivated species, together with many weeds,
owe their presence to the visits of European ships, starting early in the seven-
teenth century and continuing with increasing frequency to the present time.
Some of these alien species find optimum conditions for growth and multiplica-
tion, and have undoubtedly played a part in limiting or even exterminating
some endemics or indigenous species through aggressiveness. A high per-
centage of the usual strand and weed species includes those frequently found
on other Pacific islands and elsewhere in tropical countries.

There is little fresh water available other than that impounded in tanks [312]
from rainfall. Aside from occasional small localized areas, the low coral islands
present a monotonous repetition of plantation weeds and fallow-resting planta-
tions of second-growth "bush." The dominant crop is coconuts, and large areas 245
have been cleared for the extensive plantations found on most of the islands.
At present, the high market value of copra makes it the most important source [434]
of income for the islanders. The second most important export crop is bananas, [439]
of which 50,000 or more cases are shipped annually to New Zealand. The more 311
rugged topography of 'Eua, and to a somewhat lesser extent of Vava'u, pre-
vents the cultivation of some parts of the islands. As a consequence, there [137]
are more opportunities on these islands for the survival of native species. Some 313
of the islands, especially 'Eua and Kao, still have significant timbered areas
with some of the tree species reaching a diameter of more than a meter and
offering a source of timber. Lumbering operations are being developed by the
government on 'Eua which, together with the fact that more and more of the
forested land is being cleared for new plantations, threaten to reduce or elimi-
nate many of the native species. Too, this has caused a soil erosion problem [311]
on some of the slopes. Lumbering operations on the volcanic islands of Late, [504]
Tofua, Kao, and Tafahi, because of the present lack of harbor facilities, are all
but impossible. It seems improbable, therefore, that much timber will be cut
on those islands in the immediate future, and it is on those islands that many
of the native species will have the best chance of survival. However, with any
marked increase in population, it will eventually become necessary to colonize
and develop such islands.

The climate of Tonga is pleasant during most of the year. The annual 132
temperature ranges from a low of around 75° F. in July and August to a high
of 85° to 90° F. from January to March. Slightly higher or lower temperatures
are not infrequent. The humidity is comparatively high, ranging from about
88° in the warmer months to a low of around 72° in the winter period. The
average mean rainfall is about 80 to 90 inches, with the wettest season during
the first six months of the year.

The collections upon which this report is based were made on the islands 101
of Tongatapu, 'Eua, Nomuka, Lifuka, Kao, Vava'u and Niuafo'ou between 126
February and June 1953. Projected visits to 'Ata, Tofua, and Late were aban-

137 in the Fijian islands from which it differs in the abruptly acute, mucronate leaves, the pale green color, and the solitary, sessile male cones. The specimens have previously been called *P. elatus* R. Brown, a species which is not found outside of Australia except in cultivation and from which it differs by the solitary male cones and the interrupted hypoderm on the upper side of the leaves. In *P. elatus* the male cones are in pairs.

FAMILY ARAUCARIACEAE

Genus **Araucaria** Jussieu

Araucaria excelsa R. Brown, in Aiton, Hort. Kew., ed. 2, 5:412, 1813 (fig. 1, *a*).

Tall, stately tree with excurrent stem and whorled, horizontal to somewhat ascending, fanlike branches. Leaves small, stiff, awl- or scale-shaped, imbricated, the cones large and woody.

Tongatapu: near beach in Nuku'alofa, Nov. 23, 1951, *Hürlimann 291.*

[824] A number of specimens of this fine ornamental tree are planted about the grounds of the palace where they have attained a height of 25 m. or more. They were not seen elsewhere in Tonga.

Tongan name: *paini.*

[245] This tree is a native of Norfolk Island, and is now widely cultivated as an ornamental.

FAMILY PANDANACEAE

Genus **Freycinetia** Gaudichaud

Freycinetia urvilleana Hombron, in Dumont d'Urville, Voy. Astrolabe et Zélée, pl. 3, 1843.

High-climbing, coarse liana, the stem up to 2-3 cm. or more thick, clinging by aerial roots. Leaves narrowly lanceolate, long-acuminate and sharply acuminate, widened and clasping at base, up to 45 cm. or more long and 5 cm. wide, approximate toward ends of stems. Flowers lacking perianth, crowded in terminal or axillary fleshy clusters, dioecious.

'Eua: June 1926, *Parks 16279;* climbing high in deep forest near center of island, Mar. 22, 1953, *Yuncker 15433.*

Occasional. Endemic to Tonga.

Tongan name: *kahikahi.*

Genus **Pandanus** Linnaeus

Pandanus tectorius Parkinson, Jour. Voy. Endeavour, 46, 1773.

Stout, branching tree, up to 5 m. or more tall, with numerous, aerial brace roots. Leaves up to 2 m. long and 7 cm. wide or smaller, apex long, slender, acuminate, margins and midrib armed with short, sharp spines. Fruit subglobose, up to 25 cm. thick.

137 Tafahi: near lower end of path to Piu 'o Tafahi, Dec. 10, 1951, *Hürlimann 401.*

Frequent, especially on the central northern islands of Tonga. Pantropic.

Scleria margaritifera Willdenow, Sp. Pl. 4: 312, 1805.

Rather stout, somewhat tufted plant, stems up to 1.5 m. tall, triangular, scabrid at angles. Leaves numerous, blades up to 30 cm. long and about 1 cm. wide or narrower, margins scabrous. Spikelets numerous, about 5 mm. long, in axillary, paniculate clusters, nutlets white or grayish lilac, globose, 2.5-3 mm. in diameter, somewhat rugose.

'Eua: on upper sea-facing terrace, in open shade, along trail to Lokupo, Mar. 27, 1953, *Yuncker 15225.*

Kao: in open area in forest, May 6, 1953, *Yuncker 15873, 15904.*

Vava'u: *Crosby;* edge of thicket-bordered grassy area at summit of Talau just west of Neiafu, May 23, 1953, *Yuncker 16140.*

Tafahi: on northeast slope of the Piu 'o Tafahi, Dec. 10, 1951, *Hürlimann 428.*

Niuatoputapu: on ridge of mountain above Vaipoa, Dec. 5, 1951, *Hürlimann 356.*

Rather frequent throughout Tonga. Australia, New Caledonia, Polynesia.

Tongan name: *mahelehele.*

FAMILY PALMAE

Genus **Pritchardia** Seemann and Wendland

Pritchardia pacifica Seemann and Wendland, Bonplandia 9: 260, 1861.

Tree with stem up to 5 m. or more tall and 30 cm. thick, bark with longitudinal fissures. Leaves fan-shaped, plicate, up to about 1 m. long, petioles stout, about as long as blade. Inflorescence large, axillary, paniculate; fruit drupelike, one-seeded, black.

Tongatapu: U.S. Exploring Expedition.

'Eua: *Lister;* on steep slope above Vaifefe, Nov. 13, 1951, *Hürlimann 271;* in thicket near shore in sandy soil, Ha'aluma, Apr. 1, 1953, *Yuncker 15607.*

Vava'u: *Crosby.*

Frequent toward the southern end of 'Eua and occasional elsewhere. Fiji and Polynesia.

● 245 824 Tongan name: *piu.* Sometimes cultivated as an ornamental.

Genus **Cocos** Linnaeus

137 245 824 **Cocos nucifera** Linnaeus, Sp. Pl., 1188, 1753.

Unbranched tree with swollen base and smooth, commonly more or less inclined trunk up to 20 m. or more tall. Leaves clustered at top, up to 4 m. or more long, pinnate, pinnae firm and coriaceous, oblong-lanceolate, long-acuminate. Flowers monoecious, in large, axillary clusters; fruit a large, one-seeded nut, enclosed in a thick, fibrous husk. Of aboriginal introduction.

C. nucifera is cultivated throughout the world in tropical countries for its many useful properties. Copra, the dried flesh of the seed, is the most important export crop of Tonga. Large plantations of coconut are located on all of the main islands. Trees also grow spontaneously outside of cultivation. 137 245 824 [439]

Tongan name: *niu*. The following varieties are recognized:

Niu kafa: fruit is large and long, but nut is very small; husk fibers are used in making a type of cordage called *kafa*. [283]
Niu kula: fruit is very small, scarcely more than 3 inches long, containing little or no liquid, cavity being filled with white pulp or jellylike substance.
Niu leka: very slow-growing variety.
Niu matakula: base of fruit where stalk joins is red.
Niu mea: fruit is yellowish in color.
Niu mealava: fruit-stalk scar has a red ring surrounding it.
Niu ta'okave: fruits are very small, some yellow and some green.
Niu tea: fruit is pale green.
Niu 'ui: fruit is green.
Niu 'utongau: fruit is mostly green, husk sweet and edible.
Niu vai: fruit is very large, mostly green but sometimes yellow.

FAMILY ARACEAE

Genus **Epipremnum** Schott

Epipremnum pinnatum (Linnaeus) Engler, Pflanzenr. 37 (IV. 23B): 60, 1908. 137

High-climbing, much-branched, coarse, subherbaceous vine. Leaves alternate, ovate-oblong, acuminate, base rounded to cordate, entire, variously perforated with large holes, or larger leaves pinnately divided nearly to midrib into numerous oblong lobes, up to 40-60 cm. long. Flowers small, crowded on a cylindrical, fleshy spadix 2-3 cm. thick and 8-10 cm. long, spadix subtended by a leaflike, lanceolate spathe as long as, or longer than, spadix.

Tongatapu: in forest near sea below Fu'amotu village, Mar. 4, 1953, *Yuncker 15172*.

'Eua: *Lister;* in dense forested ravine north of Fuai, Mar. 19, 1953, *Yuncker 15369*.

Vava'u: near summit of Talau, west of Neiafu, May 24, 1953, *Yuncker 16158*.

Common throughout Tonga in forested areas. Burma to the Philippines and Polynesia.

Raphidophora pertusa var. *vitiensis* Engl. in Hemsley's list.

Tongan name: *alu*.

The long slender stems (called *kaho alu*) are used in the weaving of baskets. [285] [824]

Genus **Colocasia** Schott

Colocasia esculenta (Linnaeus) Schott, Melet. Bot. 1: 18, 1832. 137

Acaulescent, tuber-forming herb. Leaves ovate-cordate, peltate, entire, acute to acuminate, of various sizes but mostly 30 cm. or more long, petiole sheathing at base. Flowers small, on a fleshy spadix surrounded by a yellowish or reddish spathe. 262 824

137 This species is of ancient introduction and is cultivated as a staple food
824 crop throughout Tonga. A large number of varieties are recognized by the
262 Tongans.

Tongan name: *talo.*

Genus **Alocasia** Necker

137 **Alocasia macrorrhiza** (Linnaeus) Schott, Oesterr. Bot. Wochenbl. 4: 409, 1854.

Large herb with stem 1 m. or more tall and up to 15 cm. or more in diameter. Leaves cordate-sagittate, glabrous, obtuse to acuminate, margins entire or wavy, up to 1 m. long and 60 cm. wide but some varieties smaller, petiole up to 1 m. or more long, sheathing at base. Flowers monoecious, on a fleshy spadix, enclosed in a greenish spathe.

Occasional in plantations. This southern Asiatic species is now widely dis-
[262] tributed in Polynesia. The stem is sometimes used as food.

[824] Tongan name: *kape.* The following varieties are recognized: *kape hina, fahenga 'uli, fahenga enge'enga.*

[247] A number of varieties of *Caladium* [*C. bicolor* (Aiton) Ventenat ?] were
[824] seen as cultivated ornamentals about dwellings.

FAMILY LEMNACEAE

Genus **Lemna** Linnaeus

Lemna minor Linnaeus, Sp. Pl., 970, 1753.

Minute, floating herb, often growing in large colonies, stem elliptic, 2-3 mm. long, green above, paler or reddish beneath, functioning as a leaf, with threadlike roots. Flowers very inconspicuous.

Tongatapu: in bay of lagoon near Pea, Nov. 23, 1951, *Hürlimann 324.*

The available material of this specimen is meager and the identification is not certain. No previous report of *Lemna* from Tonga is known.

Of Old World origin, now of wide distribution.

FAMILY BROMELIACEAE

Genus **Ananas** Adanson

Ananas comosus (Linnaeus) Merrill, Interpret. Herb. Amboin., 133, 1917.

[245] The pineapple is seen occasionally in plantations, but I saw no extensive plantings.

[824] The Tongan name for the pineapple is *faina.* The following varieties are recognized: *faina,* fruit of medium size, the leaf margins spiny; *faina ha'amoa,* fruit large and not as sweet as other varieties, the leaf spiny only toward the apex: and *faina 'initia,* the leaves at the top of the fruit red.

76: Yuncker N-4,5 (1953) 1959 OU9 Tonga OU9

Hemsley (Linn. Soc. Bot., Jour. **30**: 193, 1895) includes this species in 137
his Flora of Tonga on the basis of a collection made by Home. One of the names applied by Fijians to this plant is *mavu ni toga*. Seemann (Fl. Vit., 252, 1865) says: "*Mavu ni Toga* literally means the *mavu* from the Tongan islands; and it is not improbable that the tree may have been introduced from there. I have not met with any specimens from Tonga in our herbaria; but that would not prove that *A. bennettii* has originally not been derived from Tonga, as that group has been explored only very superficially, and Sir E. Home found it east of Fiji, viz. at Wallis Island in long. 176° W."

No specimens of this tree were found and no reference was made to any plant of this description by Tongans: nor have I been able to verify the accuracy of the Hemsley citation. If it occurs in Tonga, it is rare.

Genus Ficus Tournefort

The following species of *Ficus* were identified by E. J. H. Corner.

Ficus aspera Forster f., De Plant. Esculent., 36, 1786.

Small tree up to 8 m. or more tall, with red or yellow fruit.

Tongatapu: *Moseley*.

New Hebrides and probably Fiji but reported from Tonga only on the basis of the Moseley collection.

Ficus carica Linnaeus, Sp. Pl., 1059, 1753.

Small tree sometimes up to 8 m. tall, young growth finely pubescent. Leaves alternate, rounded-ovate in outline, palmately lobed and nerved, bluntly acute, base cordate, finely pubescent, petioles about as long as blade. Flowers dioecious, fruit large, pear-shaped, fleshy, edible.

The edible fig of commerce, this Asiatic species is now widely cultivated [245]
in warm countries. Several well-grown trees were seen in Tonga.

Ficus obliqua Forster f., Fl. Ins. Australium, Prodr., 77, 1786.

Broad-topped tree, up to 30 m. or more tall. Leaves alternate, elliptic or elliptic-oblanceolate, acute, base acute or slightly cordulate and obtuse, entire, glabrous, up to 8 cm. or more long and 4 cm. wide, pinnately nerved, midrib prominent, lateral nerves fine and inconspicuous, petioles up to 2 cm. long. Fruit about 5 mm. in diameter, globose, orange-colored.

Tongatapu: behind post office, Nuku'alofa, Nov. 23, 1951, *Hürlimann 289;* growing in open forest near Navutoka village, Feb. 27, 1953, *Yuncker 15122;* growing about a semi-dead tree along the trail between Fatai village and sea, Mar. 10, 1953, *Yuncker 15251.*

'Eua: in seaside forest, Ha'aluma, Apr. 1, 1953, *Yuncker 15603.*

Lifuka: in thicket near sea along coast north of Pangai village, Apr. 24, 1953, *Yuncker 15744.*

Genus **Annona** Linnaeus

137 **Annona muricata** Linnaeus, Sp. Pl., 536, 1753.

Small tree. Leaves alternate, oblong or oblong-elliptic, acute or acuminate, glabrous, somewhat glossy above, up to about 14 cm. long and 4 cm. wide, petioles short. Flowers 2-3 cm. or more long, yellowish green, solitary or in pairs; the fruit fleshy, heart-shaped, up to 15 cm. or more long, covered with short, fleshy spines, seeds numerous, embedded in the white, juicy, somewhat acid, edible pulp.

Tongatapu: in a garden in Nuku'alofa, Mar. 8, 1953, *Yuncker 15219.*

245 824 Occasional in villages as an introduced fruit tree. From tropical America. Now widely cultivated in tropical countries.

Tongan name: *'apele 'initia.*

Annona reticulata Linnaeus, Sp. Pl., 537, 1753.

Small to medium-sized tree. Leaves alternate, elliptic- or oblong-lanceolate, acute, up to 17 cm. long and 5 cm. wide, pinnately nerved, the petioles about 12 mm. long. Flowers about 2.5 cm. long, axillary; the fruit about 10 cm. thick, smooth, divided into hexagonal areas, edible.

245 824 Occasional in villages. From tropical America. Now widely cultivated in tropical countries for its fruit.

Annona squamosa Linnaeus, Sp. Pl., 537, 1753.

Small tree. Leaves two-ranked, oblong or elliptic-lanceolate, acute, up to 12 cm. or more long and 4-5 cm. wide, the petioles about 1 cm. long. Flowers solitary, greenish yellow, about 2.5 cm. long, petals narrowly lanceolate, obtusish, concave at base; fruit about 8 cm. thick, somewhat heart-shaped, tuberculate, sweet, edible.

Tongatapu: *U.S. Expl. Exped.*

Vava'u: *Crosby.*

245 824 Occasional in villages. From tropical America. Now widely grown in tropical countries for its fruit.

Tongan name: *'apele papalangi.*

FAMILY MYRISTICACEAE

Genus **Myristica** Linnaeus

Myristica hypargyraea A. Gray, U.S. Expl. Exped., Bot. 1: 33, 1854.

Medium-sized tree, up to 10 m. or more tall, the twigs minutely puberulent glabrescent. Leaves oblong-elliptic, acute, base obtuse or acute, up to 35 cm. or more long and 12 cm. wide, pinnately nerved, midrib prominent, lateral nerves slender, green above, whitish beneath, petiole stout, up to 2 cm. long. Flowers small, axillary, brown-pubescent; fruit rounded-ovoid, densely brown-pubescent, up to 4 or 5 cm. long, with deeply lacinated aril.

Tongatapu: *U.S. Expl. Exped.;* near lagoon at Fatai, Oct. 30, 1951. *Hürlimann 56;* in open woods near Vaini village, Feb. 26, 1953, *Yuncker 15064.*

'Eua: *Lister;* in open forest along trail to summit of eastern ridge, Mar.

'Eua: border of eastern ridge in central part of island, Nov. 9, 1951, *Hürlimann 206;* in dry, open, grazing area on western slope of eastern ridge, Apr. 6, 1953, *Yuncker 15652;* on sea-facing limestone cliff near summit of eastern ridge, Apr. 8, 1953, *Yuncker 15679.* 137

In Tonga, apparently limited to the eastern ridge on the island of 'Eua. Also known in the Ryukyu and Bonin Islands, the Hawaiian Islands, Pitcairn, and other islands of Polynesia.

Genus **Eriobotrya** Lindley

Eriobotrya japonica (Thunberg) Lindley, Linn. Soc., Trans. 13: 102, 1821.

Low, evergreen tree, up to about 6 m. tall. Leaves clustered toward ends of stout, pubescent stems, alternate, elliptic, or oval-oblanceolate, sharply acuminate, base cuneate, up to 20 cm. or more long, sharply toothed, glossy above, rusty-woolly beneath, pinnately nerved, petiole short, winged. Flowers white, fragrant, 1-2 cm. wide, in terminal, branching, densely woolly clusters; fruit yellow, globose, downy, edible.

Tongatapu: side of trail near Nualei village, Mar. 9, 1953, *Yuncker 15223.*

Cultivated for its fruit and occasionally as an escape. A native of China now widely cultivated. [245] [824]

Tongan name: *loketi.*

Genus **Parinarium** Aublet

Parinarium glaberrimum Hasskarl, Tijdschr. Nat. Ges. 10: 147, 1843 [*nomen nudum*]; Flora 27: 583, 1844.

Small to rather large tree, up to 10 m. or more tall. Leaves alternate, elliptic-oblong or ovate-lanceolate, acute, base rounded, obtuse, up to 20 cm. or more long and 8 cm. wide, entire, somewhat coriaceous, pinnately nerved, midrib with two glands near base. Flowers crowded, in branching, pubescent, axillary, racemose clusters, corolla whitish, anthers yellow, on bluish filaments; fruit large, brown, rough.

Tongatapu: in Nukunuku village, Jan. 11, 1952, *Hürlimann 679;* below Fatai village, Mar. 10, 1953, *Yuncker 15261.*

Vava'u: *Crosby;* along road west of Houma village, May 22, 1953, *Yuncker 16119.*

Tafahi: in grassy area, Tafahi township, Dec. 15, 1951, *Hürlimann 568.*

In villages and occasionally in forested areas. From Java and Borneo eastward to Polynesia.

P. laurinum A. Gray in Burkill's list.

Tongan names: *pipi, pipi failolo.*

The seeds are used to scent oil. [303] [824]

Parinarium insularum A. Gray, U. S. Expl. Exped., Bot. 1: 488, pl. 54, 1854.

Somewhat twiggy tree up to 12 m. or more tall. Leaves alternate, ovate or lance-ovate, acute to acuminate, the base rounded, obtuse or cordulate, 7-8 cm. long and 3-4 cm. wide,

76: Yuncker N-4,5 (1953) 1959 OU9 Tonga OU9

137 glossy above, pinnately nerved, areolate-nervulose, nervules prominent beneath, petiole about 5 mm. long, stout. Fruit ellipsoidal, brown-scurfy, 4-5 cm. long.

Vava'u: *Crosby;* near Mataika village, May 27, 1953, *Yuncker 16205.* Infrequent.

Also in Fiji and Samoa.

Tongan name: *hea.*

247 The garden rose (*Rosa* spp.) is planted as a common ornamental about
245 dwellings. One depauperate peach tree (*Prunus persica* Siebold and Zuccarini)
824 was seen in Nuku'alofa.

FAMILY CONNARACEAE

Genus **Santaloides** [Linnaeus] O. Kuntze

Santaloides samoense (Lauterbach) Schellenberg, in Engler Bot. Jahrb. **58**: 180, 1923; Pflanzenr. **103** [IV. 127]: 122, 1938.

Woody vine, glabrous throughout. Leaves alternate, odd-pinnate, leaflets ovate or round-ovate, acuminate, base rounded, obtuse, blade margin sometimes subpeltately continuous over petiolule, up to 6 cm. or more long and 4 cm. wide, pinnately nerved, areolate venulose, somewhat chartaceous, petiolules about 5 mm. long. Flowers 4-5 mm. wide, white, on slender pedicels about as long as flowers in paniculate clusters.

'Eua: climbing in forest on western slope near summit of central part of eastern ridge, Mar. 24, 1953, *Yuncker 15442.*

Kao: climbing in trees, on rocky forested slope, May 6, 1953, *Yuncker 15890.*

Tongan names: *kavahaha, tuamea.*

The cited specimens agree very well with an isotype of the species, *Vaupel 491* (US), thus providing what appears to be a new generic record for Tonga (A. C. Smith).

FAMILY LEGUMINOSAE

Genus **Serianthes** Bentham

Serianthes myriadenia Planchon, ex Bentham, Hook. London Jour. Bot. **5**: 108, 1846.

Broad-topped tree, up to 8 or 10 m. tall, branchlets, leaves, and so forth brown-pubescent. Leaves bipinnate, alternate, pinnae several, up to 10 cm. or more long, leaflets numerous, oblong, obtuse, base cordulate, asymmetrical, about 12 mm. long and 5 mm. wide, sessile. Flowers several, in branching, axillary clusters, calyx about 1 cm. long, dentate, densely pubescent, corolla greenish yellow, up to 2 cm. long, lobed to about middle, pubescent, stamens numerous, exserted, deep red; pod oblong, somewhat compressed.

Vava'u: *Crosby;* at summit of Talau, west of Neiafu, May 23, 1953. *Yuncker 16141.*

Infrequent. Fiji.

Tongan name: *mohemohe.*

Genus **Bauhinia** Linnaeus

Bauhinia monandra Kurz, Asiatic Soc. Bengal, Jour. 42(2):73, 1874. 137

Shrub or small tree with brown-hairy young growth. Leaves alternate, rounded-ovate in outline, up to 10 cm. or more wide, deeply cleft a third or more of its length into two winglike lobes, otherwise entire, palmately nerved. Flowers white, pink and yellow variegated, in terminal or axillary racemes, with solitary stamen; pod elongated, up to 15 cm. or more long.

An introduced ornamental, rather frequent in villages and occasionally an escape. A tropical American species now widely cultivated. [245] [824]

Genus **Cassia** Linnaeus

Cassia javanica Linnaeus, Sp. Pl., 379, 1753.

Rather small tree. Leaves alternate, pinnate, up to about 30 cm. long, leaflets oval, obtuse, up to 5 cm. long. Flowers pink and white, in large racemose clusters; pod cylindrical, up to 30 cm. or more long.

An introduced ornamental, this Malayan species is now widely cultivated. A few specimens of what was taken to be this species were noted in villages. It is probable that *C. fistula* Linnaeus also is present, though it was not noted. *Cassia alata* Linnaeus is frequent in dooryards. [245] [824] [351]

Cassia leschenaultiana de Candolle, Soc. Phys. Hist. Nat. Genève, Mém. 2: 132, 1824.

Pubescent, subshrubby herb, up to 80 cm. or more tall. Leaves pinnate, alternate, up to about 7 cm. long, leaflets linear-oblong, apex rounded, mucronate, base obliquely inequilateral, up to 30-40 on each leaf, 1-2 cm. long and 3 mm. wide, essentially sessile. Flowers yellow, 1-1.5 cm. wide, several, in axillary fascicles; pods up to 5 cm. long and 4 mm. wide, very thin, linear, slightly falcate.

Vava'u: roadside between Mataika and Feletoa villages, May 19, 1953, *Yuncker 16023.*

Infrequent. A pantropic weed, possibly of Asiatic origin.

Tongan name: *mateloi vava'u.*

Cassia occidentalis Linnaeus, Sp. Pl., 377, 1753.

Glabrous, erect, branching herb, up to 1 m. or more tall, slightly woody at base. Leaves alternate, even-pinnate, leaflets mostly 10 or 12, elliptic- or ovate-lanceolate, acuminate, base inequilaterally rounded, up to 7 cm. or more long and 2-3 cm. wide, petiolules 1-2 mm. long, petiole with a conspicuous gland near base. Flowers yellow, about 2.5 cm. wide, in few-flowered, axillary, racemose clusters; pods flat, glabrous, falcate, up to 12 cm. or more long.

'Eua: *Lister.*

Lifuka: in thicket near beach north of Pangai village, Apr. 24, 1953, *Yuncker 15708.*

Occasional. A tropical American species now pantropic in distribution.

Tongan name: *pi.*

137 **Cassia sophera** Linnaeus, Sp. Pl., 379, 1753.

Subshrubby herb, up to 1 m. or more tall, young parts somewhat pubescent. Leaves alternate, even-pinnate, leaflets about 14, lanceolate or lance-ovate, acuminate, base somewhat obliquely acute, 3-4 cm. long and 1-1.5 cm. wide, petiolules about 1 mm. long. Flowers yellow, about 2 cm. wide, several, in axillary, pedunculate, racemose clusters.

Tongatapu: *Forster; Home.*

'Eua: in waste area near Ohonua village, Apr. 2, 1953, *Yuncker 15620.*

Tafahi: on stone wall in Tafahi township, Dec. 15, 1951, *Hürlimann 576.*

Occasional as a plantation and waste-area weed. Pantropic.

Tongan name: *matui.*

Cassia toro Linnaeus, Sp. Pl., 376, 1753.

Erect, slightly woody plant, up to about 1 m. tall. Leaves alternate, pinnate, leaflets commonly six, oval-obovate, obtuse, base obliquely obtuse, finely pubescent, petiolules 1-2 mm. long. Flowers yellow, about 1-2 cm. wide, in axillary pairs on short peduncles; pods slender, up to 15 cm. long and 3 mm. thick.

Tongatapu: roadside near air field of Fu'amotu, Nov. 3, 1951, *Hürlimann 144;* in clearing near Navutoka village, Feb. 27, 1953, *Yuncker 15078.*

Vava'u: roadside above Ta'anea village, May 21, 1953, *Yuncker 16085.*

An occasional waste-area weed. A tropical American species now widespread in warm countries.

Tongan names: *te'ekosi, pini papalangi.*

Genus **Delonix** Rafinesque

Delonix regia (Bojer) Rafinesque, Fl. Tellur. 2: 92, 1836.

Rapidly growing, medium-sized, round-topped, spreading tree with smooth, light-colored bark. Leaves alternate, up to 60 cm. long, bipinnate, leaflets very numerous, oblong, obtusish, base oblique, subsessile. Flowers bright red, 8 cm. or more wide, petals clawed, upper petal with whitish or yellowish streaks; pods flat, pendent, up to 30 cm. or more long and 3 to 5 cm. wide.

Niuatoputapu: ornamental tree in Falehau village, Dec. 7, 1951, *Hürlimann 379.*

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824

Occasional in villages as an ornamental. An African species now widely cultivated in warm countries.

Tongan name: *'ohai.*

Genus **Caesalpinia** Linnaeus

Caesalpinia crista Linnaeus, Sp. Pl., 380, 1753.

Scandent or scrambling shrub with long branches and leaves armed with sharp, recurved spines or prickles, young parts brown-pubescent. Leaves large, bipinnate, leaflets oblong to ovate, acuminate, mucronate, base rounded, obtuse, up to 8 cm. long and 4 cm.

wide but mostly somewhat smaller, petiolules 2-3 mm. long. Flowers in supra-axillary, racemose clusters, calyx greenish brown, corolla yellow; pod nearly lenticular, prickly, about 5 cm. long, seeds smooth, glossy, nearly round, very hard. 137

Tongatapu: in seaside forest below village of Lavengatonga, Mar. 6, 1953, *Yuncker 15195.*

Nomuka: sprawling over shrubs in thicket along shore above village, Apr. 30, 1953, *Yuncker 15868.*

Vava'u: *Crosby.*

Niuatoputapu: in forest on edge of mountain range above Vaipoa, Dec. 5, 1951, *Hürlimann 351.*

Occasional throughout Tonga. Widespread in warm countries.

C. bonducella Flem. in Hemsley's list. For discussions relative to the complicated nomenclature of this species, see Urban (Symb. Ant. 2: 269, 1900) and Merrill (Philippine Jour. Sci. 5C: 53, 1910).

Tongan name: *talatala'amoa.*

The slender, prickly stems are used to make snares with which to capture fruit bats. [224] [824]

Caesalpinia pulcherrima (Linnaeus) Swartz, Observ. Bot., 166, 1791.

Glabrous shrub or small tree, up to 2 m. or more tall, branches usually armed with short, stiff, scattered prickles. Leaves alternate, bipinnate, leaflets oblong, obtuse or shallowly emarginate, base obliquely inequilateral, up to 2.5 cm. long, light green. Flowers red or orange, about 2.5 cm. wide, on long pedicels in large, terminal racemes, stamens long-exserted; pods oblong, flat, up to 10 cm. long.

'Eua: *Lister.*

Occasional as an ornamental. Widely cultivated in warm countries. [245] [824]

Genus **Sophora** Linnaeus

Sophora tomentosa Linnaeus, Sp. Pl., 373, 1753.

Shrub, up to about 4 m. tall, densely gray-pubescent. Leaves alternate, odd-pinnate, leaflets up to about 21, obovate or suborbicular, apex rounded, obtuse, base obtuse or slightly acute, up to 5 cm. or more long and 3.5 cm. wide, petiolules about 3 mm. long. Flowers yellow, about 2 cm. long, on pedicels about 5 mm. long, in terminal racemes up to 15 cm. or more long; pods up to 15 cm. long, strongly constricted between seeds.

Tongatapu: *U.S. Expl. Exped.; Graeffe;* small island in lagoon northeast of Fatai, Oct. 30, 1953, *Hürlimann 80;* outer margin of seaside thicket, Sopu, west of Nuku'alofa, May 30, 1953, *Yuncker 15297.*

'Eua: seaward margin of strand thicket, Ha'aluma, Apr. 1, 1953, *Yuncker 15588.*

Nomuka: in thicket near sea a short distance above village, Apr. 30, 1953, *Yuncker 15865.*

Frequent in strand thickets throughout Tonga. Pantropic.

Tongan names: *lala, fetu'a tahi.*

Genus **Citrus** Linnaeus

137 **Citrus maxima** (Burmann) Merrill, Interpret. Herb. Amboin., 296, 1917.

Tree up to 10 m. tall, branches spiny, twigs compressed, green. Leaves elliptic or ovate-oblong, entire, apex retuse, up to 10-12 cm. long, the petioles obovate-winged. Flowers white, fragrant, several, in short, axillary racemes; the fruit up to 15 cm. or more in diameter, the rind thick, the pulp yellow or reddish, rather dry, scarcely edible.

Occasional in forests and thickets throughout Tonga. Not seen in cultivation.

C. decumana L. of Hemsley's list.

Tongan name: *moli tonga.*

[245] [824] [302] Oranges (*moli kai*), limes (*laime*), citrons, mandarins (*moli peli*), kumquats, grapefruit (*moli kalepi*), and lemons (*lemani*) are cultivated. Lemons are often found growing naturally. A number of large fruiting trees occur in the forest above Fuai plantation on the island of 'Eua. *Moli uku,* a form producing inedible fruit sometimes used for washing hair, was reported but not seen.

FAMILY SIMAROUBACEAE

Genus **Suriana** Plumier

Suriana maritima Linnaeus, Sp. Pl., 284, 1753.

Shrub or small tree up to 3 m. or more tall, the younger parts and leaves finely pubescent. Leaves alternate but closely spaced, simple, linear-spatulate, very shortly acutish, gradually narrowed to short petiole, up to about 3 cm. long and 3-5 mm. wide. Flowers yellow, in subterminal, racemose clusters, petals about 8 mm. long; capsule five-parted, pubescent.

Tongatapu: forming thicket near beach below Fu'amotu village, Mar. 4, 1953, *Yuncker 15193.*

'Eua: in sandy soil just above high-tide limit, Ha'aluma, Apr. 1, 1953, *Yuncker 15594.*

Lifuka: *Harvey;* in thin soil on rocky cliff along northern end of island, May 11, 1953, *Yuncker 15982.*

Islets near Vava'u: *Crosby.*

Niuatoputapu: on coral sand, coast south of Matavai, Dec. 26, 1951, *Hürlimann 628.*

Common in strand thickets on most of the islands of Tonga. Pantropic.

Tongan name: *ngingie.*

FAMILY BURSERACEAE

Genus **Canarium** Linnaeus

Canarium harveyi Seemann, Fl. Vit., 35, 1865.

Tree up to 12 m. or more tall. Leaves alternate, pinnate, leaflets oval-oblong or ovate, entire, somewhat glossy, acuminate, base rounded, obtuse, up to 15 cm. long, pinnately

Genus **Acalypha** Linnaeus

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Acalypha boehmerioides Miquel, Fl. Ind. Bat., Suppl., 459, 1860.

Small, finely pubescent, semi-woody plant, branching from base, up to 60 cm. or more tall but mostly somewhat shorter. Leaves alternate, ovate, acute, the base obtuse or acutish, three- or five-nerved from base, midrib branched upward, up to 3 cm. or more long and 2.5 cm. wide, crenate, nerves often reddish, petiole slender, up to 3 cm. long. Flowers small, greenish, in spicate, axillary clusters.

Vava'u: *Crosby.*

Niuatoputapu: south of Falehu toward southeast coast, Dec. 7, 1951, *Hürlimann 396.*

Occasional as a weed. Malaysia to Polynesia.

Tongan name: *hongohongo.*

Acalypha grandis Bentham, in Hook. London Jour. Bot. 2: 232, 1843.

Shrub or small tree up to 4 m. or more tall, young branches canescent-pubescent. Leaves alternate, broadly ovate, acuminate, base rounded, obtuse or cordate, coarsely dentate, up to 15 cm. or more long, minutely pellucid-dotted, palmately nerved, petiole mostly 5-12 cm. long. Inflorescences unisexual, male spikes 7-12 cm. or more long, female spikes usually much longer; capsule pubescent.

Tongatapu: *Home.*

Samoa, Fiji, and probably westward to Malaysia.

Acalypha hispida Burmann f., Fl. India, 303, pl. 61, fig. 1, 1768.

Shrub, up to 2 m. tall, branches pubescent. Leaves alternate, ovate, toothed, up to 10 cm. or more wide, acuminate. Flowers in red, cylindrical, axillary catkins up to 20 cm. or more long.

Introduced ornamental, occasional in villages. An East Indian species now widely cultivated in warm countries.

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Acalypha insulana Mueller-Argoviensis, Flora 47: 439, 1864, var. **insulana.**

Rather densely spreading-pilose shrub up to 5 m. or more tall. Leaves alternate, ovate, elliptic or lanceolate, two or more times longer than wide, acuminate, base subcordate to acute, pinnately nerved, petiole up to 7 cm. long. Inflorescences spicate, unisexual, bracts dentate, hairy; fruit densely hairy.

Tongatapu: *Moseley.*

Infrequent. Fiji and presumably westward, at least to New Guinea.

Acalypha repanda Mueller-Argoviensis, Flora 47: 439, 1864, var. **repanda.**

Shrub up to 5 m. tall, young branches puberulent. Leaves alternate, elliptic or elliptic-ovate, acuminate, base rounded, obtuse or cordulate, up to 15-20 cm. or more long and 9-10 cm. wide, pinnately nerved, crenulate, petiole up to 7 cm. or more long. Flowers very small, in axillary, spicate clusters.

'Eua: in deep forest near summit of eastern ridge, Mar. 30, 1953, *Yuncker 15560.*

Infrequent. New Guinea eastward to Samoa.

137 **Acalypha wilkesiana** Mueller-Argoviensis, in DC. Prodr. 15(2): 817, 1866.

Shrub, up to 2 m. or more tall, branches pubescent. Leaves mostly ovate, serrate, up to 20 cm. or more long and 15 cm. wide, acuminate, pubescent, mottled with various shades of red, yellow, and bronzy green. Flowers monoecious, small, on slender, axillary spikes up to 15 cm. or more long.

245 824 Introduced ornamental, frequently used as a hedge plant. Widely cultivated in warm countries. Although the type is from Fiji, the actual origin of the species is questionable.

Tongan name: *kalakala 'apusi.*

Genus **Ricinus** Tournefort

Ricinus communis Linnaeus, Sp. Pl., 1007, 1753.

Large, coarse, semi-woody, glabrous shrub or small tree with spreading, hollow branches. Leaves alternate, round-ovate in outline, peltate, mostly deeply palmately five- to nine-lobed, lobes sharply acuminate, serrate, up to 20 cm. or more long and as wide, palmately nerved, petiole about as long as blade. Flowers monoecious, small, in large terminal or axillary paniculate clusters; capsules three-seeded, spiny, seeds about 1 cm. long, smooth, variegated.

Tongatapu: *Moseley;* edge of old plantation near Niutoua village, Mar. 2, 1953, *Yuncker 15110.*

'Eua: in waste area near village of Ohonua, Apr. 2, 1953, *Yuncker 15618.*

Vava'u: *Crosby.*

Occasional in waste areas throughout Tonga. A native of the Old World, now pantropic in distribution.

Tongan name: *lepo.*

251 The leaves are used for wrapping shellfish.

Genus **Aleurites** Forster

Aleurites moluccana (Linnaeus) Willdenow, Sp. Pl. 4: 590, 1805.

Tree up to 10 m. or more tall, branches, leaves and inflorescence brown-stellate-scurfy. Leaves light green, alternate, ovate or ovate-lanceolate, acute, base truncate or cordulate, entire, or palmately three- or five-lobed, lobes triangular, acute, three- to five-nerved from base, midrib branched upward, up to 20 cm. or more long and 15 cm. wide but mostly somewhat smaller, petiole as long as or longer than blade. Flowers small, greenish yellow or white, in large, many-flowered, terminal, paniculate clusters; fruit about 5 cm. in diameter when mature, subglobose.

Tongatapu: *Moseley; Forster;* margin of coastal forest, near Vaini village, Feb. 26, 1953, *Yuncker 15058.*

'Eua: *Lister;* along trail between Pangai village and Fuai, Mar. 25, 1953, *Yuncker 15460;* toward eastern ridge, near Fuai, alt. 60 m., Nov. 8, 1951, *Hürlimann 157.*

Lifuka: about midisland along road between Pangai village and east coast, Apr. 27, 1953, *Yuncker 15754.*

Vava'u: *Crosby;* in thicket along road near sea below the village of Houma, May 22, 1953, *Yuncker 16135.* 137

Frequent throughout Tonga. Southern Asia and Malaysia to Polynesia.

Tongan name: *tuitui.*

An extract of the bark is used for dyeing, and oil obtained from the fruit is used in a number of ways. [386] [824]

Genus **Jatropha** Linnaeus

Jatropha curcas Linnaeus, Sp. Pl., 1006, 1753.

Glabrous shrub or small tree up to 5 or 6 m. tall. Leaves alternate, round-ovate, three- or five-lobed, lobes acuminate, base cordate with broad sinus, palmately seven-nerved, midrib and lateral nerves strongly branched upward, 15 cm. or more long and as wide, petiole commonly longer than blade. Flowers greenish-white, 6-8 mm. wide, in axillary, pedunculate, cymose clusters; capsule up to 3 cm. long.

Tongatapu: in thicket near village of Niutoua, Mar. 2, 1953, *Yuncker 15116.*

'Eua: in thicket near Ohonua, Apr. 2, 1953, *Yuncker 15637.*

Lifuka: along road about midisland between Pangai village and eastern side of island, Apr. 27, 1953, *Yuncker 15774.*

Vava'u: *Crosby.*

Frequent throughout Tonga. A tropical American species now of pantropic distribution.

Tongan name: *fiki.*

Often grows in rows about plantations, along roads, and other places where it is used as living fence posts. An extract of the leaves is used in preparing medicines. [824] [245] [278]

Jatropha multifida Linnaeus, Sp. Pl., 1006, 1753.

Shrubs or small tree up to about 6 m. tall. Leaves nearly round in outline but deeply divided into seven to 11 lobes, the lobes entire or incised, glabrous. Flowers bright red, in compound, cymose clusters.,

Tongatapu: *Setchell and Parks 15548.*

Occasional in villages. A native of tropical America, now widely planted as an ornamental.

Tongan name: *fiki papalangi.*

Genus **Manihot** Tournefort

Manihot esculenta Crantz, Inst. Rei Herb. 1: 167, 1766.

Glabrous, half-woody, shrubby plant, up to about 2 m. tall. Leaves alternate, paler beneath, deeply palmately parted into three to seven lanceolate, entire, acuminate divisions, up to 20 cm. or more long and about as wide. Flowers monoecious, about 2 cm. wide, yellowish-green or reddish, in few-flowered, axillary, paniculate clusters, often not developing; fruit subglobose, about 1.5 cm. in diameter, ridged.

137 [241] [824] [262] Cultivated[1] throughout the group for its edible roots. A tropical American species now of pantropic cultivation.

Tongan name: *manioke*. The following varieties are recognized:

Manioke falaoa: stem is pale green, the tuber white.

Manioke hina: stem and leaves are pale green; the skin of the tuber is brown without, pink within.

Manioke koka'anga: stem is dark red, the leaves dark violet, the skin of the tuber is red; the tuber is bitter unless properly prepared and is used to prepare an adhesive paste.

Manioke leka hina: stem and leaves are pale green, the tuber white.

Manioke leka kula: stem is light brown, the petiole red, and the skin of the tuber dark red.

Genus **Codiaeum** Jussieu

Codiaeum variegatum (Linnaeus) Blume, Bijdr. Fl. Java, 606, 1825.

Densely branched, glabrous shrub. Leaves alternate, varying greatly in shape and size, commonly entire, sometimes interrupted or twisted, pinnately nerved, mostly acuminate, variegated green, red, pink, yellow, and white. Flowers small, monoecious, in axillary, racemose clusters.

'Eua: *Lister.*

Tafahi: in cemetery beneath the township of Tafahi, alt. 30 m., Dec. 17, 1951, *Hürlimann 594.*

● [245] [824] Cultivated as an ornamental throughout Tonga. Pantropic.

Genus **Croton** Linnaeus

Croton storckii Seemann, Bonplandia 10: 297, 1862.

Shrub with sparse, stellate pubescence glabrescent. Leaves alternate, ovate, short-acuminate, base rounded, bi-glandular, up to 10 cm. long and 5 cm. wide, the petiole up to 2.5 cm. long. Flowers small, in terminal, racemose clusters up to 5 cm. long.

Vava'u: *Crosby 150.*

Also in Fiji.

C. microtiglium Burkill (Linn. Soc. Bot., Jour. 35: 54, 1901). See also the note by A. C. Smith (B. P. Bishop Mus., Bull. 141: 83, 1936).

Genus **Excoecaria** Linnaeus

Excoecaria agallocha Linnaeus, Syst., ed. 10, 1288, 1759.

Tree up to 10 or 12 m. tall, the latex white, adhesive, irritating. Leaves alternate, glabrous, oval or oval-obovate, acutish or rounded and retuse, base obtuse to acutish, bi-glandular, up to 8 cm. or more long and 6-7 cm. wide, pinnately nerved, lateral nerves slender and inconspicuous, petiole up to 2 cm. long. Flowers monoecious, small, male flowers in many-flowered, axillary spikes up to 5 cm. or more long, female flowers in axillary racemes up to 3 or 4 cm. long; capsules subglobose, about 5 mm. in diameter.

Tongatapu: *Cook; Home;* in thicket, Sopu, Feb. 25, 1953, *Yuncker 15025;* in swampy area near Navutoka village, Feb. 27, 1953, *Yuncker 15072;* near Fatai toward sea, Oct. 30, 1951, *Hürlimann 62.*

[1] /Manihot esculenta -- Analyst/

Euphorbia prostrata Aiton, Hort. Kew. **2**: 136, 1789. 137

Low, prostrate, widely spreading, slender-stemmed herb. Leaves small, opposite, oval-obovate, obtuse, base obtusely obliquely inequilateral, serrulate. Flowers minute, in small axillary clusters.

Tongatapu: in sandy waste area, Navutoka village, Feb. 27, 1953, *Yuncker 15090.*

‘Eua: in waste area near center of island, Apr. 5, 1953, *Yuncker 15645.*

Frequent as a lawn weed about dwellings and in waste areas throughout Tonga. Pantropic.

Euphorbia pulcherrima Willdenow, ex Klotz. in Otto and Dietrich, Allgem. Gartenz. **2**: 27, 1834.

Erect, glabrous, branching, soft-wooded shrub, up to 2 m. or more tall. Leaves elliptical or elliptic-ovate, acute, entire or sinuate-toothed or lobed, pubescent, up to 25 cm. or more long and 15 cm. wide, on petioles up to about 8 cm. long, upper leaves near inflorescence commonly lanceolate and bright red. Flowers comparatively small and inconspicuous, yellow and reddish green.

Cultivated throughout Tonga as an ornamental. A native of Mexico now widely cultivated in warm countries. [245/824]

Tongan name: *lave‘imoa.*

Euphorbia ramosissima Hooker and Arnott, Bot. Beechey Voy., 69, 1832.

Small, subwoody plant with short, thickened, decumbent stems and numerous, slender, ascending branches. Leaves oval-ovate, obtuse, base obliquely rounded, cordulate, up to 1 cm. long, entire, petiole about 2 mm. long. Flowers small, white, in small, axillary clusters.

‘Eua: *Lister.*

Vava‘u: *Crosby.*

Tafahi: on rocks near shore, Fakafafa moe Tauloto, Dec. 17, 1951, *Hürlimann 609.*

Occasional. Also in Fiji and Niue.

Includes *E. sparmannii* Boiss. of Hemsley's list.

Genus Breynia Forster

Breynia nivosa (Bull) Small, Torrey Bot. Club, Bull. **37**: 516, 1910.

Shrub or small tree with glabrous, spreading, two-ranked branches. Leaves alternate, two-ranked, oval-ovate, entire, variegated with yellow and red, obtuse or abruptly pointed, petioles short, stipules very small, triangular-acute. Flowers monoecious, small, green, on short, axillary pedicels.

Occasional as a hedge plant in villages. A species of the south Pacific now widely cultivated as an ornamental in warm countries. [245/824] irregularly toothed, up to 8 cm. or more long and as wide, stellate-pubescent, petioles up to 5 cm. or more long. Flowers on short axillary pedicels, corolla white to pink; fruit about 1 cm. wide, the five segments covered with barbed spines, burlike. 137

Tongatapu: *U.S. Expl. Exped.;* along forest trail near Niutoua village, Mar. 2, 1953, *Yuncker 15136.*

'Eua: in clearing near center of island, Mar. 24, 1953, *Yuncker 15434.*

Vava'u: *Harvey; Crosby.*

Frequent as a roadside and waste-area weed. An Indo-Malaysian species now pantropic.

Hemsley lists *U. morifolia* DC. for Tonga on the authority of de Candolle and cites no collections. This is now considered to be a synonym of *U. sinuata* Linnaeus which is now treated as a synonym of *U. lobata.*

Tongan name: *mo'osipo.*

The leaves[1] are used in medicines. [824] [278]

Genus **Hibiscus** Linnaeus

Hibiscus abelmoschus Linnaeus, Sp. Pl., 693, 1753.

Hirsute, subwoody plant, up to about 1 m. tall. Leaves alternate, broadly ovate in outline, up to 12 cm. long and about as wide, base cordate, palmately three- to five-lobed, lobes acute to acuminate, toothed, petioles about as long as the blade. Flowers 5 cm. or more wide, solitary, on axillary pedicels up to 5 cm. or more long, corolla yellow with an orange or red center; capsule oblong, pointed, 5 cm. or more long, hirsute, splitting into five sections.

'Eua: *Lister;* scattered plants in undergrowth of old coconut plantation near Ha'aluma, Apr. 1, 1953, *Yuncker 15585.*

Vava'u: *Barclay; Crosby;* in wet, marshy edge of Ngofe swamp, on southwestern side of island, May 20, 1953, *Yuncker 16030.*

Occasional in waste areas. India to Malaya and Polynesia.

Tongan names: *loa, fau'ingo.*

The seeds furnish a dye used in decorating tapas, and various parts of the plant are used in preparing medicines. [824] [386] [278]

Hibiscus rosa-sinensis Linnaeus, Sp. Pl., 694, 1753.

Shrub up to 3 m. or more tall. Leaves simple, alternate, ovate, acute, base obtuse or subacute, up to 15 cm. or more long and 12 cm. wide, dentate, palmately five-nerved, petiole up to about 5 cm. long. Flowers up to 12 or 15 cm. wide, on slender, elongate axillary pedicels near ends of branches, various shades of red.

Cultivated about villages as an ornamental. Occasionally adventive. An Asiatic species now cultivated in warm countries throughout the world. [245] [824]

Hibiscus schizopetalus (Masters) Hooker f., Curtis's Bot. Mag. III, **36**: pl. 6524, 1880.

Glabrous shrub up to about 3 m. or more tall. Leaves alternate, ovate-elliptical, acute, dentate. Flowers solitary, pendulous on long pedicels at ends of slender, drooping branches, petals much dissected, reflexed, coral red.

[1] /Urena lobata -- Analyst/

Occasional[1] in villages as an ornamental. A native of tropical Africa now widely cultivated in warm countries.

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824

Hibiscus syriacus Linnaeus, Sp. Pl., 695, 1753.

Erect, branching, glabrous shrub 2 m. or more tall. Leaves rhombic-ovate, alternate, lower ones often three-lobed, toothed, acute to acuminate. Flowers up to 8 cm. wide, red or purplish, solitary in leaf axils on current season's growth; fruit ovoid, up to 2.5 cm. long.

Introduced ornamental. Occasional. A Chinese species now of worldwide cultivation in tropical and temperate countries.

Hibiscus tiliaceus Linnaeus, Sp. Pl., 694, 1753.

Tree up to 8 m. or more tall with glabrous or somewhat pubescent, spreading branches. Leaves round-ovate, abruptly acuminate, base deeply cordate with a narrow sinus, up to 15 cm. or more long and nearly as wide, palmately seven- to nine-nerved, glabrescent above, paler and densely stellate-pubescent beneath, petioles up to 12 or 15 cm. long. Flowers up to 10 cm. wide, on short, axillary and terminal pedicels, corolla yellow with darker eye, turning salmon red; capsule pubescent, five-celled, several-seeded, seeds glabrous.

Tongatapu: thicket near beach, Sopu, west of Nuku'alofa, Feb. 25, 1953, *Yuncker 15027*.

'Eua: *Lister;* in thin forest below Fuai plantation, near center of island, Mar. 19, 1953, *Yuncker 15358*.

Lifuka: in seaside thicket just above high-tide limit, north of Pangai village, Apr. 25, 1953, *Yuncker 15742*.

Vava'u: *Harvey; Crosby.*

Tafahi: coastal forest, below township of Tafahi, Dec. 13, 1951, *Hürlimann 490*.

Frequent throughout Tonga, usually near the shore. Pantropic.

Tongan name: *fau*.

824
283
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757

The bark fibers are used in making cordage, mats, *tauvale,* kava filters, and so forth. The wood is used in general construction work and fences: the bark and young leaves, in the treatment of skin diseases.

Genus **Thespesia** Solander

Thespesia populnea (Linnaeus) Solander, ex Correa, Mus. Nat. Hist. Nat. Paris, Ann. 9: 290, 1807.

Medium-sized, round-topped tree, the young branches brown-scurfy. Leaves simple, alternate, somewhat fleshy, ovate, acuminate, base cordate with an open sinus, entire or rarely somewhat lobed, palmately five- to seven-nerved, up to 12 cm. or more long and 10 cm. wide, petioles up to 10 cm. or more long. Flowers up to 8 or 10 cm. wide, solitary, on stout, axillary pedicels, corolla yellow with reddish center, changing to purple with age; capsules depressed-globose, about 2.5 cm. in diameter, seeds 10, hairy.

Tongatapu: seaside thicket near Niutoua village, Feb. 27, 1953, *Yuncker 15107*.

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[1] /Hibiscus schizopetalus -- Analyst/

137 polygamous-dioecious, white or cream-colored, fragrant, female flowers sessile, axillary, male flowers smaller, in loose, paniculate clusters, on long, axillary peduncles; fruit green to yellow, of various shapes, up to 20 cm. or more long, flesh red orange, central cavity lined with small, round, black seeds.

[245] [824] Commonly cultivated[1] in villages and plantations throughout the group and frequent as an escape. A tropical American plant now cultivated as a food plant in most warm countries.

Tongan name: *lesi.* The following varieties are distinguished:

[262] *Lesi 'initia:* there are two forms of this variety, one with long fruit, the other with short, oval fruit.

Lesi meleni: the flesh is pink and not as sweet as the other varieties.

Lesi tonga: there are two forms of this variety, one with long fruit, the other with short, oval fruit.

FAMILY LYTHRACEAE

Genus **Pemphis** Forster

Pemphis acidula J. R. and G. Forster, Char. Gen. Pl., 68, pl. 34, 1776.

Low, sprawling, silky-pubescent shrub. Leaves opposite, lanceolate or elliptic-spatulate, acutish, up to about 2.5 cm. long and 6 mm. wide, entire, subsessile, crowded. Flowers solitary, axillary, about 15 mm. wide, petals white, membranous; fruit turbinate, about 6 mm. long.

Tongatapu: on coral rocks near shore, near Niutoua village, Mar. 2, 1953, *Yuncker 15132.*

'Eua: *Lister;* on coral rocks along strand at Lokupo, Mar. 27, 1953, *Yuncker 15524.*

Lifuka: scrambling over rocks along shore, Apr. 27, 1953, *Yuncker 15766.*

Vava'u: *Crosby; Harvey.*

Niuatoputapu: toward southeast coast near Falehau, Dec. 7, 1951, *Hürlimann 386.*

Frequent on rocks and cliffs along the shore throughout Tonga. From eastern Africa and tropical Asia eastward to Polynesia.

Tongan name: *ngingie.*

Genus **Lagerstroemia** Linnaeus

Lagerstroemia indica Linnaeus, Syst., ed. 10, 1076, 1759.

Shrub up to 3 m. or more tall, twigs somewhat quadrangular. Leaves alternate, elliptic or elliptic-subobovate, obtuse or acute, up to about 5 cm. long, subsessile. Flowers about 3 cm. wide, petals suborbicular, clawed, pink to lavender, in terminal or axillary paniculate clusters.

[245] [824] Introduced ornamental which is occasional in villages. A Chinese species now widely cultivated in warm countries.

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[1] /Carica papaya -- Analyst/

Genus Quisqualis Linnaeus

137 **Quisqualis indica** Linnaeus, Sp. Pl., ed. 2, 556, 1762.

[824] [245] A tropical Asiatic vine widely planted for ornamental purposes. Occasional about dwellings in Tonga.

[133]

FIGURE 12.—Sinkhole on central plateau of 'Eua island. Much of the "bush" is *Psidium guajava*.

FAMILY MYRTACEAE

Genus Psidium Linnaeus

Psidium guajava Linnaeus, Sp. Pl., 470, 1753 (fig. 12).

Shrub or small tree, up to 3 m. or more tall, young branches quadrangular, pubescent. Leaves simple, opposite, oval-elliptic or oblong, apex rounded, base obtuse or acutish, up to 12 cm. or more long and 6 cm. wide, rather thick, pubescent beneath, prominently pinnately nerved, petiole up to about 1 cm. long. Flowers about 2.5 cm. wide, axillary, corolla white; fruit size of a small lemon, yellow, flesh pink when ripe, fragrant, edible.

Tongatapu: in thicket along road near village of Niutoua, Mar. 2, 1953, *Yuncker 15112.*

Occasional to frequent throughout Tonga; rather large colonies grow on 'Eua. It appears to be spreading in Tonga and promises to become a pernicious weed. A tropical American species of relatively recent introduction.

Tongan name: *kuava.*

[824] [262] The fruit is used as food.

Genus **Decaspermum** Forster

Decaspermum fruticosum J. R. and G. Forster, Char. Gen. Pl., 74, pl. 37, 1776. 137

Pubescent shrub, up to 2 m. or more tall. Leaves opposite, lanceolate or lance-ovate, acute to acuminate, base acute, decurrent on petiole, entire, up to 4 cm. long and 2 cm. wide, pale-glandular-dotted beneath, pinnately nerved, lateral nerves very slender. Flowers about 1 cm. wide, terminal and axillary on small, reduced, axillary branches, corolla white; fruit about 4-5 mm. in diameter, black.

Tongatapu: *U.S. Expl. Exped.; Graeffe.*

'Eua: *Lister;* in thicket at summit of eastern ridge, Mar. 30, 1953, *Yuncker 15555.*

Kao: in margin of lake near summit, about 990 m. alt., May 6, 1953, *Yuncker 16256.*

Vava'u: *Crosby.*

Occasional at upper altitudes throughout Tonga. Occasionally used as an ornamental shrub. Southern Asia, Malaya, and Australia to Polynesia. [245] [824]

Nelitris fruticosa A. Gray and [?] *N. forsteri* Seem. in Hemsley's and Burkill's lists.

Tongan name: *nukonuka.*

Genus **Eugenia** Linnaeus

Eugenia rariflora Bentham, Hook. London Jour. Bot. 2:221, 1843.

Low shrub or small tree, up to 4 m. tall. Leaves opposite, elliptic-ovate or elliptic-obovate, obtuse or acutish, base acute, up to 7 cm. or more long and 4-5 cm. wide, entire, glossy above, paler beneath, petioles mostly 2-4 mm. long. Flowers axillary or terminal, corolla white; fruit subspherical, 10 mm. or more in diameter, red.

Tongatapu: *Home;* in dense forest near sea, below village of Lavengatonga, Mar. 6, 1953, *Yuncker 16192.*

'Eua: *Lister.*

Vava'u: *Crosby;* in thicket along the upper rim of the seaside cliff above Ha'alaufuli, May 21, 1953, *Yuncker 16099.*

Occasional throughout Tonga. Pacific islands.

E. rariflora f. *parviflora* Hemsl. in Hemsley's list.

Genus **Syzygium** Gaertner

Syzygium amicorum (A. Gray) C. Mueller, Walpers Ann. Bot. Syst. 4:839, 1857.

Shrub or small to medium-sized tree with terete branches. Leaves subacuminate, base cuneate, pinnately nerved, lateral nerves obvious. Inflorescences axillary and terminal, open, usually no longer than subtending leaves, flowers white, fruit purplish.

Tongatapu: *Cook; Forster; Home.*

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Vava'u: *Crosby;* in forest on slope above Anovai Lake, May 18, 1953, *Yuncker 16050;* near upper edge of seaside cliff along northwestern side of island, May 25, 1953, *Yuncker 16181.* 137

In forests and thickets, usually on seaside cliffs. Also in Samoa.

Tongan name: *kulukulu.*

The large leaves are used for wrapping fish.[1] [824] [251]

Genus **Polyscias** Forster

Polyscias multijuga (A. Gray) Harms, in Engler and Prantl, Nat. Pflanzenfam. 3(8): 45, 1894.

Small tree with thick, pithy stems and branches, up to 5 m. tall. Leaves pinnate, leaflets 9-13, oval-oblong, acuminate, base more or less inequilaterally obtuse, entire, up to 15 cm. or more long and 6 cm. wide, pinnately nerved, petioles vaginate and winged toward base, clasping. Flowers very small, numerous, in large, branching, axillary clusters, up to 60 cm. or more long.

Tongatapu: in dense thicket near shore, Blow Hole area, near Houma village, June 1, 1953, *Yuncker 16227.*

'Eua: *Lister.*

Locally abundant. Also on Niue Island.

Panax multijugum Benth. and Hook. f. in Hemsley's list.

Tongan name: *tanetane.*

Genus **Nothopanax** Miquel

Nothopanax fruticosum (Linnaeus) Miquel, Fl. Ind. Bat. 1(1): 765, 1856.

Glabrous shrub, up to 3 m. or more tall. Leaves decompound, up to 30 cm. or more long, leaflets quite variable in form, often more or less lanceolate, often laciniated and spiny-toothed, up to 10 cm. long, terminal leaflet usually largest, often with white margins. Flowers small, greenish white, in small umbels, forming large, terminal, paniculate clusters; fruit flattened, ribbed.

Tongatapu: *Home.*

A tropical Asiatic plant of frequent cultivation in Polynesia as an ornamental. The various forms have been given varietal names.

Reported by Hemsley in his list as *Panax fruticosum* L.

Nothopanax guilfoylei (Cogniaux and Marché) Merrill, Philippine Jour. Sci. 7C: 242, 1912.

Shrub or small tree up to 3 m. or more tall, with abruptly ascending branches. Leaves alternate, odd-pinnate, green with white margins, leaflets coarsely sharp-toothed, mostly five or seven, terminal leaflet largest, petiole clasping stem. Flowers and fruit rare, in terminal, racemose clusters.

An introduced ornamental, commonly planted in hedges or about dwellings. Pantropic. This species occurs in a number of varieties showing differences in the character of the leaflets, two or three of which were noted in Tonga. [824] [245] [351]

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[1] / Mertya macrophylla -- Analyst/

Family PLUMBAGINACEAE

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Genus **Plumbago** Linnaeus

Plumbago capensis Thunberg, Prodr. Fl. Cap., 33, 1794.

Smooth shrub with long, slender, furrowed branches, often somewhat scandent in trees or shrubs. Leaves oblong, obtuse, narrowing to short petiole. Flowers light blue, clustered near ends of branches, corolla tubular with spreading lobes, tube up to about 3 cm. long, calyx with glandular hairs.

[824] [245] Cultivated in villages as an ornamental. A South African species now widely cultivated in warm climates.

Family SAPOTACEAE

Genus **Burckella** Pierre

Burckella richii (A. Gray) H. J. Lam, Blumea **6**: 592, 1952.

Tree, up to 15 m. tall, trunk 35-75 cm. in diameter, latex milky. Leaves clustered toward ends of branches, elliptic or elliptic-obovate, apex rounded or bluntly pointed, base acute to cuneate, firm, entire, pinnately nerved, lateral nerves slender, up to 14 or 15 cm. long and 6 or 7 cm. wide but mostly smaller, petiole mostly 1-5 cm. long. Flowers white, 1-2 cm. wide, attractive, on pedicels up to 2 cm. or more long, in terminal fascicles; fruit ellipsoidal, up to 3.5 cm. long and 2.5 cm. thick, one-seeded, short-stipitate, smooth, apiculate with thickened style base about 5 mm. long.

Tongatapu: near village of Niutoua on eastern side of island, Mar. 2, 1953, *Yuncker 15126;* in open area near Mua village toward eastern end of island, June 3, 1953, *Yuncker 16237.*

Nomuka: in thicket on lake side of road encircling island between sea and central lake, Apr. 30, 1953, *Yuncker 15859.*

Lifuka: edge of Pangai village, Apr. 28, 1953, *Yuncker 15789.*

Tonga, without other locality, *U.S. Expl. Exped.* (US 653903).

In making this combination, Lam cited only the type (U.S. Expl. Exped.: US 65307), which is from Tongatapu. This specimen is quite identical in foliage with those cited above, but the single flower now available seems to be underdeveloped. The relationship of *B. richii* to the more recently described *B. microphylla* H. J. Lam and van Olden (B. P. Bishop Mus., Bull. **154**: 34, pl. 1, *B*, 1938) should be investigated in the light of the new collections. *B. microphylla* is mentioned as occurring in Samoa and Tonga, the type specimen being from Vava'u and a second Tongan specimen, from Tongatapu. Significantly, the Tongan name is given as ***kau***. On the basis of the original description and plate, *B. microphylla* may not be separable from *B. richii*. (A. C. Smith.)

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137 cm. wide, densely silvery hairy. Flowers small, very numerous, white, sessile, in large, branching, long-pedunculate, scorpioid-cymose clusters; fruit round, four-parted, about 7 mm. in diameter.

Tongatapu: *Forster;* seaward margin of coastal forest fringe, below village of Niutoua on eastern side of island, Mar. 2, 1953, *Yuncker 15130.*

'Eua: *Lister;* along outer margin of seaside thicket, Lokupo, on northeastern side of island, Mar. 27, 1953, *Yuncker 15538.*

Lifuka: in thicket just above upper tidal limit along beach north of Pangai village, Apr. 24, 1953, *Yuncker 15712.*

Vava'u: *Crosby.*

Rather frequent near shore throughout Tonga. From tropical Asia through Malaysia to Australia and Polynesia.

Tournefortia argentea L. f. in Hemsley's list.

Tongan name: *touhuni.*

FAMILY VERBENACEAE

Identifications of the Verbenaceae are by H. N. Moldenke.

Genus **Lantana** Linnaeus

Lantana camara Linnaeus var. **aculeata** (Linnaeus) Moldenke, Torreya 34:9. 1934.

Scabrous-pubescent shrub, up to 4 m. or more tall, armed with short, recurved prickles. Leaves simple, opposite, ovate, acute at both ends, up to 7 cm. or more long and 4-5 cm. wide, pinnately nerved, crenate, petioles about 1 cm. long. Flowers 5-7 mm. long, several, in compact, headlike clusters, on axillary peduncles up to about as long as leaves, corolla tubular, yellow or orange, turning purplish.

Tongatapu: in thicket near shore, about 2 km. west of Nuku'alofa, Feb. 25, 1953, *Yuncker 15002.*

'Eua: in thicket near center of island, Mar. 22, 1953, *Yuncker 15426.*

Occasional. A tropical American species now pantropic in distribution, especially this thorny variety.

Tongan name: *talatala.*

[824] [245] The brush is sometimes used to support yam vines.

Genus **Stachytarpheta** Vahl

Stachytarpheta urticaefolia (Salisbury) Sims, Curtis's Bot. Mag. 43: pl. 1848, 1816.

Subherbaceous plant up to about 1 m. tall, widely branching. Leaves opposite, oval-ovate, acute, base cuneate-decurrent, serrate, up to 8 cm. or more long and 4 cm. wide, pinnately nerved, smooth or slightly hairy, petioles winged by blade margins. Flowers numerous, sessile, in groove-like depressions in a spike-like rachis up to 50 cm. or more long, corolla deep blue, opening successively from base upward and quickly deciduous.

Tongatapu: in sandy soil near beach below Navutoka village, Feb. 27, 1953, *Yuncker 15105*. 137

A common roadside and waste-area weed throughout Tonga. Widespread in tropical countries.

Tongan name: *iku'ikuma.*

Genus **Duranta** Linnaeus

Duranta repens Linnaeus, Sp. Pl., 637. 1753.

Shrub up to 4 m. or more tall, twigs sparsely hairy, sometimes spiny. Leaves opposite or in whorls, oval, acute at both ends, 5-8 cm. or more long and 2 cm. wide, obscurely toothed above middle. Flowers tubular, about 8 mm. long, blue, on short pedicels, in axillary and terminal paniculate clusters; fruit about 6 mm. long, orange.

'Eua: in margin of forest on terrace above village of Houma, Mar. 26, 1953, *Yuncker 15499*. This specimen obviously an escape.

Infrequently cultivated ornamental in Tonga. A tropical American species widely cultivated in warm countries as an ornamental. 824 245

Tongan name: *'olive.*

Genus **Premna** Linnaeus

Premna obtusifolia R. Brown, Prodr. Fl. Nov. Hollandiae, 512, 1810.

Shrub or dwarf tree, the young growth puberulent. Leaves opposite, oblong-ovate, obtuse or abruptly acute, base obtuse or cordulate, up to 8 cm. long and 5 cm. wide, crenate-serrate, petiole mostly less than 1 cm. long. Flowers small, greenish, in terminal, branching clusters; fruit globose, about 3 mm. in diameter.

'Eua: on western slope of eastern ridge in dry, open areas, Mar. 24, 1953, *Yuncker 15438*.

Occasional. Malaya, Philippines, tropical Australia to Polynesia.

Tongan name: *volovalo.*

Premna taitensis Schauer var. **rimatarensis** F. B. H. Brown, B. P. Bishop Mus., Bull. 130: 248, 1935.

Shrub or small tree up to 5 m. or more tall, stems nearly glabrous. Leaves opposite, ovate, acute or obtuse, base obtuse or cordate, up to 10 cm. long and 6 cm. wide, glabrous or nearly so above, subglabrous below except woolly vein axils, petioles 2-3 cm. long. Flowers small, greenish white, in terminal, puberulent panicles; fruit globose, about 6 mm. in diameter.

Tongatapu: in swampy area between Navutoka village and sea, Feb. 27, 1953, *Yuncker 15076*.

'Eua: *Lister;* in thin forest along trail to summit of eastern ridge above Fuai, Mar. 20, 1953, *Yuncker 15376*.

Nomuka: in thicket on lake side of road encircling island, Apr. 30, 1953, *Yuncker 15850*.

Nomuka: margin of thicket along road encircling island between sea and inland lake, Apr. 30, 1953, *Yuncker 15816.*

Lifuka: roadside ditch between Pangai village and southern end of island, Apr. 28, 1953, *Yuncker 15780.*

Vava'u: along road between Mataika and Feletoa, northwest of Neiafu, May 20, 1953, *Yuncker 16053.*

Occasional as a plantation and waste-area weed throughout Tonga. A tropical American plant now widespread in warm countries.

Tongan name: *te'ekosi totolo.*

Salvia coccinea Jussieu, Murray, Soc. Reg. Sci. Gott. Comm. 1: 86, 1778.

Freely branching, hairy herb, up to about 60 cm. tall. Leaves ovate, acute or obtuse, base truncate or subcordate, up to 5 cm. or more long, crenate-serrate, petioles rather slender. Flowers bright red or pink, corolla puberulent, about twice as long as calyx.

Vava'u: *Crosby.*

A tropical American species rather widespread as a weed in waste areas.

S. pseudo-coccinea Jacq. in Burkill's list.

Tongan name: *te'ekosi.*

Genus **Coleus** Loureiro

Coleus amboinicus Loureiro, Fl. Cochinchinensis, 372, 1790.

Low, densely pubescent, aromatic herb. Leaves opposite, ovate, acute or obtusish, base cuneate, up to 12 cm. or more long and 9 cm. wide, coarsely toothed, finely pubescent on both sides, petiole up to 5 cm. or more long. Flowers pale lavender, on short, slender pedicels, in whorls in a terminal, interrupted, racemose cluster.

Tongatapu: garden, Nuku'alofa, 1926, *Setchell and Parks 15414;* in border of plantation near Nualei village, Mar. 9, 1953, *Yuncker 15232.*

Nomuka: sandy soil near sea below village, Apr. 30, 1953, *Yuncker 15861.*

Lifuka: roadside north of Pangai village, May 10, 1953, *Yuncker 15797.*

Frequent as a waste-area and roadside weed throughout Tonga. From India and Malaya to Polynesia.

Tongan names: *pasiole, kaloni.*

The plants are extremely aromatic. The leaves are added to the water for washing clothes to perfume them and are used for scenting oil. [824] [296] [303]

Coleus blumei Bentham, Labiat. Gen. and Sp., 56, 1832.

Erect, tender, square-stemmed, brown-pubescent herb, up to about 1 m. tall. Leaves opposite, ovate, crenate, up to 15 cm. long, acute, often dark red above, red and green beneath, petioles long and slender. Flowers light blue, subsessile, in whorls on an elongated terminal spike.

Frequent as an ornamental about dwellings, in cemeteries, and so forth. Occasional specimens were noted as escapes along roadsides. An East Indian species now of worldwide cultivation. [824] [245] [351] [764]

Genus **Datura** Linnaeus

137 **Datura stramonium** Linnaeus, Sp. Pl., 179, 1753.

Coarse, hollow-stemmed, weedy plant, divaricately branched, up to 1.5 m. tall. Leaves ovate, acute at both ends, alternate, up to 20 cm. long, coarsely toothed, petiole rather long. Flowers 8-10 cm. long, corolla white or pale violet, funnelform, gradually widening upward; capsule ovoid, up to 5 cm. long, spiny.

Vava'u: *Crosby.*

Infrequent. An Asiatic species of worldwide distribution as a weed in temperate and tropical countries.

Genus **Cestrum** Linnaeus

Cestrum diurnum Linnaeus, Sp. Pl., 191, 1753.

Shrub, up to 3 or 4 m. tall. Leaves alternate, elliptic-oblong, acute at both ends, up to 10 cm. long and 3 cm. wide, glabrous, petiole about 1 cm. long. Flowers about 1.5 cm. long, glabrous, in cymose clusters on axillary peduncles up to 5 cm. or more long, very fragrant, calyx tube obscurely toothed, corolla lobes short, blunt, recurved; berry ellipsoidal to subspherical, about 1 cm. long, purple black when ripe.

Lifuka: in thicket, edge of plantation along road north of Pangai village, Apr. 24, 1953, *Yuncker 15710.*

Vava'u: along street leading to wharf in Neiafu, May 22, 1953, *Yuncker 16138.*

[824] [245] Cultivated as an ornamental and occasional as an escape. A West Indian species, now widely planted as an ornamental in warm countries.

Tongan name: *vaitohi.*

Genus **Nicotiana** Linnaeus

Nicotiana fragrans Hooker, Bot. Mag. 81: pl. 4865, 1855, var. **fragrans.**

Low plant with short, prostrate, woody stems up to 1 cm. thick. Leaves clustered at ends of stems, obovate-spatulate, apex rounded, base cuneate-decurrent, up to 10 cm. or more long and 4 cm. wide, pubescent, petiole winged by decurrent leaf-blades. Flowers white, on erect stalks up to 30 cm. tall.

Tongatapu: in soil pockets on perpendicular face of seaside cliff, Fangaveha, on southern coast of island, June 7, 1953, *Yuncker 16252.* (Identified by T. H. Goodspeed.)

Very rare in Tonga. Known also from the Isle of Pines, New Caledonia, and from Lifu in the Loyalties.

Nicotiana tabacum Linnaeus, Sp. Pl., 180, 1753.

Erect, glandular-pubescent herb, up to 1 m. or more tall. Leaves alternate, oval, obtuse to acuminate, base rounded, clasping the stem. Flowers mostly 3-5 cm. long, glandular-pubescent, in terminal, paniculate clusters, corolla tubular, pink or red; capsules many-seeded.

226 Fish nets (*finaki*). A fish net is made from the leaves of the
coconut palm. The roots are plaited into a round net very much like
[286] a lobster net; when ready it is sunk in the sea, weighed down by a
stone or some heavy weight. The fish swim into an opening in the net.

USES OF THE COCONUT PALM

824 The coconut tree is considered by the natives to be the most useful
tree in Tonga. It is indispensable in house building, and the number
[181] of articles made from its wood and leaves is remarkable. The heart
[278] of the tree is used for making walking sticks, the bark for medicine,
[226] the roots for a kind of fish net called *finaki*, the leaves for baskets,
[285] [342] thatching houses, and making mats and flooring. The uses of the
[352] fruit are innumerable.

824 As a medicine the fruit is given to pregnant women to increase
853 the supply of breast milk. For this the green nuts are used. A new-
[843] born child is always given *namoa*, which is made from the roasted
flesh of the ripe nut. This roasted flesh is chewed by someone,
usually a woman, and when taken from the mouth is rolled in a piece
of *fetaaki*, squeezed, and the juice given to the child. This is his
only food for four days.

824 Ripe coconuts are valuable for copra, which is the dried flesh.
[439] This is sold to European markets largely, where it is used for soap,
candles, oils, and a variety of products. The shells of the coconut are
[314] burned and made into charcoal (*malala*) for ironing. Kava cups also
[415] are made from the shells.

824 No native food is considered complete without the presence of
262 coconut in one form or another. Yams, fish, and bananas are usually
[252] cooked in the milk extracted from the flesh of the ripe coconut and
strained through coconut fiber.

824 Brooms are made from the ribs of the leaf, and the leaf stem is
[412] used for stirring oil, also as weights for tapa which is spread on the
[287] ground for printing. The bark (*kaka*), which surrounds the leaves
[415] at the body of the palm, is used to make bags for wrapping arrow-
root and medicines.

The several varieties of coconut palms have different uses.

VARIETIES OF COCONUT PALMS

● 245 KAFA. The nut is gathered when green and husked, the husk put in a native
824 oven and left for two weeks, after which it is taken out and beaten to re-
[285] move all the dust. The fiber thus obtained is plaited into mats.

NIU UI. NIU MEA. A clay-colored nut.

NIU MATA KULA. A red-eyed nut, used as a medicine for gum boils. 245 824

NIU MEAALAVA. A green nut, used as a medicine for gum boils in young children. The husk at the top of the nut is grated and spread over the boil. [757]

NIU KAFAKALA. A great favorite among the chiefs, because of its perfect shape and size. The milk has a delicious flavor. [272]

NIU VAI. The largest coconut obtained in the South Seas. In the early days these shells were used for carrying water and when thus used were termed *hohoni*. [415]

NIU TAUKAVE. Has a small fruit.

NIU TEA. A white nut.

NIU UTOGAU. A nut with a sweet husk which the natives chew like sugar cane. [262]

NIU LEKA. This tree grows to a height of only ten feet and has a dwarf nut.

NIU KULA. A very different variety of coconut from all the others on the island. The nut is the size of a man's thumb; it has no milk, but a lump of white jelly surrounded by a thin, white, bitter skin. The tree is tall with a smooth body.

GAMES PLAYED BY CHILDREN

857 524 In the game, *kamotu'u*, several boys sit forming a ring; one goes to the center, closes his eyes, and stands looking upward until a boy from the circle touches him on the foot or leg. He then opens his eyes and goes to each boy in the circle, snapping his fingers in the face of each. When his fingers snap the loudest he has found the boy who touched him.

In *galigali a toke*, the boys stand in a row with hands on each other's hips. One player stands alone, facing the line. When the game begins, the line of boys starts running in a ring, and the lone player (*ell*), tries to catch any boy behind the leader of the line. While the game is being played this song is sung: "Galigali a toki, tuki be he ulu e toke." (Looks like an *ell* trap, but punch the *ell* on the head).

To play *touhuhu*, the boys hang a shaddock (*moli toga*) to a tree or stick and stand around it with sharpened sticks in their hands. One boy pierces the fruit with his stick, and strikes it to start it spinning around. The other boys then try to spear it while it is spinning, and the one who accomplishes this first wins the game.

Another game for boys is *tafau*. This is played with native bows and arrows. The weapon is made by taking a *kaho* stick about a yard long, splitting it down about twelve inches, and twisting one end of a piece of *fau* bark around the stick at the place where the split stops. The other end of the *fau* bark is held in the hand. The *kaho* stick or arrow is swung over the shoulder in playing, very much as if one

423 Cabinet approval is illegal, and Cabinet approval is not given
427 for land renting between Tongans. In fact, some of the more
241 enterprising and large-scale banana growers and market gardeners,
who can afford to pay rent and to contribute food crops
and pigs to the estate-holder or landholder, have little difficulty
in obtaining the use of land, though their tenure is insecure and
423 unprotected by law. Land cannot be borrowed for planting
coconuts, a long-term cash crop, and palms on an allotment are
425 the property of the landholder, regardless of who planted them.
● 245 A common practice for those without land, therefore, is to
obtain permission to collect one or two cart loads of coconuts
for copra making from the allotment of a relative or close friend,
and for this no return is given. Another arrangement, especially
between non-relatives and where the landholder lives elsewhere,
is for the cash received for the copra to be shared half and half.
434 Despite these arrangements a survey undertaken in four villages
in Tongatapu showed that in 1961 the *per capita* cash crop
[24] income of households with no land ($T18.40) was only half that
of households with eight acres (Maude 1965:155-6). Yet only a
few of the landless men interviewed throughout Tonga seemed
to experience hardship from land shortage; most considered their
income sufficient for essential needs and some with energy and
enterprise had higher cash incomes than many men with their
own allotments. A few men in Ha'apai and Nuku'alofa with
large families to support, however, did appear to feel under
pressure.

423 In theory the Tongan system should have encouraged the
movement of people from areas of land shortage to the more
166 sparsely populated districts, for although an estate-holder may
425 refuse a person from another locality permission to reside upon
his estate, he cannot prevent such a person holding an allotment there, unless the Land Court rules against the grant. Some migration to obtain land has taken place over the last few decades, mainly from Ha'apai to central and eastern Tongatapu, but for reasons already mentioned it has not been easy to obtain land in the areas where allotments should have been available. Furthermore, acquiring land on an hereditary estate has usually been more difficult for a stranger to a village than for a local man, for the responsibility of an estate-holder towards his own people does not necessarily extend to others, and many people feel that the lands of an estate should be reserved for the people who traditionally belong there. Consequently in all the villages for which figures are available the proportion of men without

land is much higher among in-migrants than among those who 423
belong there by birth (Maude 1965:118-19, Nayacakalou 1959:111), 166
and the difficulty and uncertainty of obtaining an allotment has 425
probably deterred migration from the densely settled areas. At the same time there has not been much opportunity for those who have allotments in these areas, but who have moved elsewhere, to exchange their old holdings for new ones (an exchange which is provided for in the Land Act) and so make land available for others, as should have happened in the case of Ha'afeva discussed earlier.

The main direction of migration within Tonga in recent years, 166
moreover, has been towards Nuku'alofa and other parts of Tongatapu 369
where the opportunities for earning money and the better
educational facilities have been more important attractions than 423
the possibility of obtaining land. People have been much less interested in moving to 'Eua and to western Vava'u, where land has been the only attraction (Maude 1965:81-6, Walsh 1964b:188). Thus internal migration has only partly led to a better distribution of land; it has had only a small effect on the tenure problems of the densely settled areas, and among the rapidly-growing population of Nuku'alofa a large proportion of households are landless. In a sample survey of households in the town Walsh (1964b:63) found that only forty-nine per cent had a tax allotment on Tongatapu, sometimes miles from the town, while another six per cent had land elsewhere in Tonga. In the 1966 census only thirty-three per cent of taxpayers in Nuku'alofa stated that they had a tax allotment.

LAND TENURE AND AGRICULTURAL PRODUCTION

The Tongan land tenure system also needs to be assessed in 121
terms of the way in which land is used. Has this system, with its individual title to land and security of tenure, proved a satisfactory basis for cash cropping, and has it fostered the development of independent small holders free of some of the problems found with more traditional systems of land tenure in other parts of the South Pacific?

Cash cropping in Tonga has been largely confined to coconuts 423
and bananas, but there is no indication that land tenure has 182
been a factor in the non-acceptance of other crops. The early 178
stages in the development of the present tenure system were 245
apparently marked by an increase in cash cropping, for Ruther-
ford (1966:58-9) quotes the opinion of Maudslay that the 1862 [241]

423 code, by increasing the commoners' security of tenure, greatly
182 stimulated the planting of coconuts. From 1887 onwards the
178 trend in copra production can be followed from the export
statistics. Between 1887 and 1912 the mean annual *per capita*
245 export of copra increased from 0.27 tons (1887-90) to 0.54 tons
[439] (1908-12), a level which was maintained, apart from the period
affected by the hurricanes of 1912 and 1913 and by the First
[433] World War, until 1930. The writer has found no evidence, however, to show whether this increase was a result of the 1882
revision of the land law.[7]

423 In recent years, on the other hand, the incomplete subdivision
and allocation of allotments has restricted further planting of
245 coconuts, and is one reason for the present low level of *per*
[182] *capita* copra production. Many parts of central and eastern
Tongatapu, and of 'Eua and Vava'u, are only sparsely planted
[433] in palms, and in central and eastern Tongatapu people with
large customary holdings have tended to plant only part of their land, while men who have moved to these districts and been given a plot to garden have not wished to plant coconuts until their tenure is secure. On several Tongatapu estates visited during field-work, where the land had been subdivided before the recent survey, the systematic planting of coconuts had only
423 begun after the subdivision and allocation of allotments. In
eastern Tongatapu in 1956 the mean *per capita* production of
245 copra was 0.48 tons on estates in which most or all of the land
433 had been subdivided into eight-and-a-quarter-acre allotments,
and 0.39 tons on estates in which most of the land remained in larger customary holdings, although these means are unfortunately based on too few villages for the difference to be statistically significant. The recent allocation of allotments in Tongatapu and elsewhere (together with the Coconut Replanting Scheme which began in 1965) should result in a marked increase in the area planted in palms, and in the opinion of some Tongans the allocation has already facilitated the recent expansion in banana planting by providing more growers with a secure tenure. There are therefore grounds for concluding that when properly applied the land tenure system does provide a good basis for agricultural development.

423 One limitation of the Tongan system, however, is its lack of
flexibility. For a variety of reasons many men find eight and a
425 quarter acres insufficient, but because of the shortage of land it
182 is now difficult, if not impossible, to obtain the ten or twelve
acre allotments provided for in the law, and there is no un-

NOTES

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[2] The correct term for this group in pre-contact Tonga is uncertain and today Tongans use the word *famili*, from English, or *matakali*, which is of Fijian origin. The term *fa'ahinga* is used by Latukefu (1967). 175 613

[3] The *matapule* are the chief's attendants and spokesmen; *foha* and *tehina* are minor titles under a chief. [565]

[4] The crosses mark allotments held by persons not belonging to the same *fa'ahinga* as the rest of the landholders in that area. 423

[5] On a government estate the process of obtaining land has generally been less difficult, but in recent years most of these estates, especially in Tongatapu, have had few vacant allotments. [613] [425]

[6] These figures are from the preliminary results of the 1966 census, by courtesy of the Census Commissioner, Mr N. Fiefia. 113

[7] It may be noted here that there are several references to the planting of coconuts having stopped in the first decade of this century (because maladministration of land matters by the King and the estate-holders made people feel insecure in their tenure), which suggests that previously planting had been common. On the other hand, the registration of allotments does not appear to have begun until 1898, and registration on a significant scale did not begin until about 1915. 423 182 178 245

[8] But note that by law an estate-holder may reserve part of his estate for himself and the successors to his title and, since the regulation provided for in the Land Act to determine the area of this *'api fakatofi'a* has never been made, some retain personal holdings of up to 200 or 300 acres, although part of this land is being used by villagers and others. 423 182 427 565

[9] From the preliminary results of the 1966 census. 000

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than the way in which they noose sharks ; instances of sharks attacking 226
natives are very rare. Whales are sometimes caught. Turtles are also 225
plentiful. Perhaps the most interesting creature in Tonga is a land-
tortoise, now kept in the Palace grounds at Nuku'alofa, and reputed to 231
have been left by Captain Cook ; it has been scarred by bush-fires and 825
other accidents, but in its old age it is honoured as though it were a chief 552
and is called Tu'imalila, after a part of Labaha called Malila.

The graceful coconut-palm is the most distinctive as well as the 245
most valuable of plants in Tonga. All parts of the islands being very
close to the sea, coconut trees thrive everywhere, and copra, the dried
kernel of the nut, is the staple product. Other plants which grow in 241
profusion are many varieties of banana, plantain, yam, sweet potato,
talo, manioc, sugar-cane, pineapple, breadfruit, papaw-apple, mango and
arrowroot. Coffee, cocoa and cotton have been introduced but are not
yet extensively grown. Various European vegetables have also been
introduced, and corn has proved the best cereal for this climate.

Bananas, sweet potatoes, pineapples, tomatoes, pumpkins and 439
oranges could be exported in abundance, if markets were available. The
staple foodstuffs of the people are yam, sweet potato, talo, manioc, kabe, 262
plantain, breadfruit, etc.

The bark of the paper-bark mulberry is extensively used for making 824
native cloth (taba and gatu), and the sap of the koka tree is used for [287]
stamping this cloth. Mats are made from the leaves of the pandanus,
but unfortunately this domestic manufacture is declining generally, [285]
except in Ha'abai. The trunks of the toa (ironwood) and koka are used [178]
for the posts of native buildings, but timber generally suitable for building [313]
European houses is not found in Tonga. The ironwood or casuarina
tree was used for making clubs and spears formerly, and is still used for
spade handles and mallets. The best of the old canoes were brought 505
from Fiji, where more suitable timber for all purposes is available. 439

Kava, the juice of a species of pepper-plant, is the national drink 276
on all occasions. Other interesting trees are the ovava, a species of
banyan ; gatae and tuitui (candle-nut) used for marking boundaries ; 137
Malayan apple or fekika, tava, and the ifi, whose leaves were hung round
the neck in token of surrender or penitence in olden times. 824

Government statistics in 1931 show a total of 2,658,644 coconut 245
trees and 832,655 banana plants in the Kingdom, 94% being owned by
Tongan cultivators.

EXPORTS.

Tonga is entirely an agricultural country, being without minerals 433
and secondary industries. It is unfortunate that there are still fairly
considerable areas of undeveloped land even in such a small country, 433
especially in Togatabu and 'Eua, and further that several hundred tax- 311
payers have no allotments ; this latter condition is mainly due to indolence
on the part of some who live in the chief towns, but in the case of the
overcrowded islands of Ha'abai it rises from rather a natural reluctance
to leave an old home. The Government is now making strenuous efforts 179
to enforce both more systematic cultivation of coconut-growing land and 245

179

245 [563] better methods of producing copra. The European planters are few, and the improvement of agriculture rightly lies with the Tongans themselves.

439 [245] [651] Copra, the chief product, is exported to England and America. Until better drying arrangements are more generally made, Tongan copra will continue to be regarded as of inferior quality; at present it is used largely in the manufacture of common soap and margarine. The Government levies an export duty of £1 per ton on copra. The quantity and value of copra exported in recent years are as follows:—

	Tons.	Value.
		£
1923	14,339	257,586
1924	14,533	297,487
1925	13,758	280,386
1926	13,992	255,156
1927	11,252	225,344
1928	15,671	282,344
1929	16,860	252,911
1930	14,134	169,609
1931	8,929	80,361

[458] The effect of the present world-wide trade-depression is apparent.

The export of bananas to New Zealand, through the Tonga Government, began in December, 1931. Since that date shipments varying from 3,000 to 9,000 cases have been sent, but the quantity has had to be restricted owing to the unfavourable ruling prices on the Auckland market. Sweet potatoes and pineapples have also been exported to Auckland in small quantities.

The only other article exported is edible fungus found on trees (taligeliga); this is sent to China, the average annual value in recent years being £530.

IMPORTS, WITH COUNTRIES OF ORIGIN.

The following are the total imports in recent years, together with total exports for purposes of comparison:—

	Imports.	Exports.
	£	£
1923	195,020	267,619
1924	232,600	306,658
1925	258,322	290,115
1926	227,882	263,198
1927	157,783	235,391
1928	211,907	287,668
1929	198,078	259,090
1930	148,305	183,204
1931	81,170	90,596

The chief imports, with their average total value in recent years, are: Drapery £28,170; meats (mostly tinned) £20,362; flour £10,894; bags (copra sacks) £7,401; hardware £6,419; motor cars and accessories

244 month) varieties. In the past, most sweet potatoes were planted from February through October, although year round planting is now common. Depending on the variety, sweet potatoes take three months to one year to mature and can be harvested throughout the year, although they are most abundant from December through February. Planting material consists of cuttings from the leaves and stems, which are planted in the loosened earth mounds.

Manioc, cassava or tapioca - manioke (Manihot esculenta). Manioc, which is native to South America, possibly Brazil (Herklots, 1972: 446), was probably introduced into Tonga early in the nineteenth century shortly after the beginning of European settlement (Barrau, 1961: 53). Because it requires almost no care or weeding, produces high yields, and can grow in the poorest of soils, it has become the widely planted staple crop on Tongatapu. [287] A number of different varieties are recognized, although most Tongans make little distinction except between edible varieties and those used in the preparation of paste for the tapa making process. Manioc is planted year round, takes from 5 to 12 months to mature, is harvested throughout the year, and will remain edible for long periods of time in the ground, providing an emergency food source in times of shortage. Planting material consists of cuttings of the stalks, which are simply pushed into loosened earth.

245 Breadfruit - mei (Artocarpus altilis). The breadfruit

245 is a traditional tree crop of possibly Indonesian or New Guinean origin (Herklots, 1972: 499), which when in season constitutes a major staple. It is found throughout Tongatapu, in both the cultivated and natural state, on both bush and town allotments. Churchward (1961: 353) lists 16 different kinds recognized by Tongans, the more common being puou, loutoko, 'aveloloa, ma'ofala, maopo, and kea. The season lasts from December through August, the different varieties ripening at different times during this period. Planting material consists of suckers or root cuttings, usually planted during the rainy season.

The plantain - hopa (Musa paradisiaca). The series of clones known as plantains constitute an important staple crop as well as a minor commercial crop. They are widely cultivated throughout Tongatapu, are native to tropical Asia (Herklots, 1972: 502), and were brought to Tonga long ago. Some cultivated today are higher yielding varieties, probably introduced after European contact (Massal and Barrau, 1956: 15-16). A number of kinds of plantains are recognized by Tongans, although most are generally referred to as hopa. The optimum planting season for plantains is from October through February or March; they take from 10 to 12 months to mature and the plants are most productive from September through May. Planting material consists of

245 suckers and pieces of the rhizome or corm from the base of mature plants, which are transplanted to suitable areas.

[439] Banana - siaine (Musa sapientum). The series of clones known as bananas are a major export crop as well as constituting an increasingly important staple food. They are widespread throughout Tongatapu, generally planted in plantations. Like the plantain, they are native to Southeast Asia, and although some types were probably present before European contact, they have been replaced in most cases by new higher yielding and more exportable clones (Massal and Barrau, 1956: 15-16). A number of kinds of bananas are recognized by Tongans, the most common groups of clones being the siaine Ha'amoa (Samoan banana) or Mons Marie; the siaine Tonga (Tongan banana) or Cavendish; the siaine Fisi (Fijian banana) or Gros Michel (Johansson, W. 1956: 3); and the pata and mamae. The planting times, time of maturation, period of optimum yield and the types of planting material are the same as for the plantain.

The coconut palm - niu (Cocos nucifera). The coconut palm, which seems to be native to tropical Asia, was either introduced by the early inhabitants of Tongatapu or arrived [262] there by natural dispersal (Baker, 1970: 48-49). It is the most common tree crop found on Tongatapu, the most important commercial crop, and provides the coconut which is used in the preparation of almost all staple food. Countless other uses are made of all parts of the tree. It

245 is found on almost all bush allotments, planted either in
systematic rows or in a random fashion, in varying numbers
on most town allotments, as well as growing naturally
along the coast. Numerous kinds of coconuts are known to
Tongans, the most common varieties being *niu kafa*, *niu mea*,
niu matakula, *niu ui*, *niu'utongau*, *niu mea'alava*, *niu leka*
245 and *niu ta'okave*. Very little scientific selection of high
242 yielding varieties is practiced, the planting material in
most cases consisting of suitable fallen nuts. With the
establishment of the Coconut Replanting Scheme, however,
new varieties from Sri Lanka were introduced and nurseries
were established to improve selection of local planting
245 material. Coconut palms are planted throughout the year,
take from seven to ten years to come into bearing, and bear
fruit through out the year.

244 Watermelon - *meleni* (*Citrullus vulgaris*). The water-
melon, which is native to the Kalahari Desert of South-
west Africa (Herklots, 1972: 314), was possibly first
introduced into Tonga by Captain Cook on his second voyage
[438] (Beaglehole, 1969: 262). It is Tonga's third most import-
[439] ant export crop, is a major item at the local market, and
is grown on bush allotments throughout Tongatapu on a
commercial basis. There are two kinds of watermelon
commonly grown, the "Ice Cream" and "Market Wonder," both
[439] of which are referred to as *meleni* by Tongans. Although
the "Ice Cream" is sweeter, the "Market Wonder" ships

244 better and is favored for export (Johansson, c. 1956: 3). [439] Although melons are planted throughout the year, the best planting time is from May to August during the drier part of the year. At this time, there is a lower incidence of fungal diseases and other pests and the melons tend to be sweeter. Watermelons take about three to four months to mature with the largest harvests occurring from August [438] through December. Planting material consists of seeds purchased either through stores in Nuku'alofa or from the Produce Board.

245 Pineapple - *fainā* (*Ananas comosus*). The pineapple is of tropical American origin (Prevost and Pitkanen, 1970:58), and was an early European introduction, probably by Cook on [438] his second voyage in 1773 (Beaglehole, 1969: 262). It is [439] grown in large patches throughout Tongatapu for export and local sale, as well as being intercropped with other crops on both bush and town allotments. The two most common varieties are the "Rough" and the "Ripley Queen", known locally as *fainā Tonga* (Tongan pineapple) and the *piu* respectively. The Ripley Queen is favored for export owing [439] to its larger size (Johansson, c. 1956: 3). The optimum planting season for pineapple seems to be from September through December; the plants begin to bear in about 14 months and are most abundant from September through January. [242] Some farmers have been producing crops throughout the year by treating the plants with a hormone. Planting material

245 consists of suckers from mature plants or the leaf-bearing
portion of the fruit.

244 **Peanuts or groundnuts** - *pinati* (*Arachis hypogaea*). The
peanut, which is thought to be native to South America
(Baker, 1970: 56), is a post-European introduction (Massal
[438] and Barrau, 1956: 30). It has been grown in Tonga for a
[439] number of years and, although a concerted attempt was made
after World War II and in the early 1960's to establish it
as an important export crop, it is now grown primarily
for local sale by street vendors in Nuku'alofa. There are
two main varieties recognized by Tongans, the *foua* or two-seeded
variety and *fo tolu* or three-seeded variety.
Although no reliable data on planting and harvesting dates
could be obtained, it seems that there are two different
planting times for peanuts, September and January; the
plants take three to four months to bear depending on the
variety and are reportedly harvested in January and May.

Tomato - *temata* (*Lycopersicon esculentum*). The tomato,
native to western Peru and Ecuador, is a comparatively
[439] recent European introduction (Herklots, 1972: 360-161). In
1971, it was Tonga's number four export crop after coconuts
(and coconut products), bananas, and watermelons respectively.
It is becoming an increasingly common addition to
the cropping complexes on bush allotments throughout
[438] Tongatapu. It is also a major item at the market in
Nuku'alofa and is often grown for home use, along with

244 **and beets - pitiluti (Beta vulgaris), all native to Europe or the Mediterranean; lettuce - letisi (Lactuca sativa) and bulb onions - onioni Palangi (Allium cepa), both native to the Middle East; cucumbers - kiukamipa (Cucumis sativus) and eggplant - paigani (Solanum melongena), both native to India; Chinese cabbage - kapisi Siaina (Brassica chinensis and B. pekingensis), native to China; and radishes - latisi (Raphanus sativus), native to Europe and Asia (Herklots, 1972). Most of these are grown infrequently, and are generally in season at the same time as tomatoes and bell peppers. The seeds are purchased primarily from large trading stores.** [438]

245 [439] **Vanilla - vanila (Vanilla planifolia). Native to Mexico (Macmillan, 1956: 330), vanilla has been successfully introduced into Vava'u where it has now become an important export crop. Within the past few years, a small number of Tongatapu farmers have also planted vanilla on their bush and town allotments. It is generally planted using the physic nut or fiki (Jatropha curcas) to climb on. As of yet, it is of little or no economic importance on Tongatapu.**

241 **Supplementary Food Plants**

In addition to staple food plants and commercial crops, there are a considerable number of supplementary, non-arborescent food plants commonly grown on bush and town allotments throughout Tongatapu. These crops include: 000

243 **Corn or maize** - *koane* (*Zea mays*). Corn or maize, a
native of Mexico (Herklots, 1972: 384), was introduced
after European contact (Massal and Barrau, 1956: 44).
[439] Although being exported on a limited basis, it is primarily
[438] a subsistence crop as well as being sold at the local
market. It is found on many bush and town allotments
throughout Tongatapu, planted either alone or intercropped
with yams, taro and other subsistence crops.

● 245 **Edible hibiscus** - *pele* (*Hibiscus manihot*). Pele,
probably native to the Southwest Pacific (Massal and
Barrau, 1956: 35) is a form of edible hibiscus, growing
[262] about three to five feet in height. It is an important
[252] green vegetable source (the leaves being cooked like spinach
with or without coconut cream), is easily cultivated, and
is commonly found throughout Tongatapu on both bush and
town allotments. Two kinds, *pele hina* and *pele kula*, are
commonly recognized by Tongans, the former being the more
common.

Papaya or pawpaw - *lesi* (*Carica papaya*). Of tropical American origin and post-European introduction (Barrau, 1971: 5), the papaya is a ubiquitous plant which provides the most common fruit on Tongatapu. It grows on almost all bush and town allotments in both wild and cultivated states and is a dominant species in many secondary vegetation communities. There are a number of varieties recognized by Tongans, the most common being *lesi Tonga*, *lesi meleni* and *lesi 'Initia*.

244 naturalized state.

245 **Passionfruit - *vaine* or *vaine Tonga* (*Passiflora edulis*).** Passionfruit, a native of tropical South America and of post-European contact introduction (Merrill, 1945: 152), is commonly grown on town allotments on trellises or trees as well as growing in a naturalized state in the [438] bush. It is occasionally sold at the market in Nuku'alofa.

Granadilla - *pasione*. (*Passiflora quadrangularis*). The granadilla, also of tropical American origin and post-European contact introduction, is commonly found growing on trellises on town allotments, and occasionally on bush allotments.

[262] **Ladyfinger-*misapeka* (*Musa clena*).** This dwarf banana, which was introduced into Tonga by Shirley Baker in the 1870's (Rutherford, 1971: 54), is infrequently cultivated on Tongatapu and is eaten in a ripened state as a fruit.

[262] **Cordyline - *si* (*Cordyline terminalis*).** *Si*, native to the Southeast Asian - Pacific region and present before European contact (Barrau, 1971: 21), is found both as an ornamental and as a cultivated or naturalized edible variety (sometimes referred to as *si kai*), which, although very common, is eaten only sparingly or in times of food shortage. It is found on most bush and town allotments, in many cases overrun by bush.

244 [262] **Cherry tomato - *temata vao* (*Lycopersicon esculentum* var. *cerasiforme*).** This variety of the common tomato,

244 [262] native to South America and a post-European contact introduction, is generally not purposefully planted, but is found on many bush and town allotments and is eaten occasionally.

Chile pepper or tabasco - *polo fifisi* (*Capsicum frutescens*). The chile pepper is native to tropical America and of post-European introduction (Herklots, 1972: 351). Like the wild tomato, it is generally found in a feral state growing amongst secondary vegetation throughout Tongatapu or occasionally in a cultivated state on both bush and town allotments.

● 245 Coffee - *kofi* (*Coffea arabica*). Coffee, a native of the Ethiopian Highlands, was probably not introduced until the latter half of the Nineteenth century (Baker, 1970: 110-112; Parham, 1972: 267). It is occasionally grown in small concentrations in isolated forest stands or under trees on bush or town allotments. Although some local coffee is prepared by a number of families, it is not produced on a commercial basis.

249 272 Lemon grass - *moengālō* (*Cymbopogon citratus*). Probably a native of Malaysia (Herklots, 1972: 483) and probably introduced around the turn of the century (Parham, 1955: 122), lemon grass is frequently planted on both bush and town allotments, the leaves being used in the preparation of tea and the roots for scenting coconut oil.

245 Hedge or fence plants. There are also a variety of plants that are used on both town and bush allotments as hedges, borders or "living fences". The most common is Nothopanax spp. (tanetane), which is commonly planted throughout Tongatapu as a living fence. Other species which are used in a similar fashion are: Hibiscus spp. (kaute); Erythrina variegata var. orientalis (ngatae); Cordyline terminalis (si); Acalypha wilksiana (kalakala'-apusi); Thunbergia erecta (paipa); and Crinum asiaticum (samoa).

247 Valuable flower plants. There are also a number of valuable flowering plants, the flowers of which are useful in the making of leis (kahoa) and other traditional adornment. Some of the most important species include: Gardenia taitensis (siale tonga); Gardenia jasminoides (siale matalateau); and Hibiscus spp.

Important Tree Species

245 One of the most salient features of the plant assemblages of bush and town allotments is the great variety of useful tree species. Many are introduced species with valuable edible fruit, but probably of even greater importance is the diversity of uses that Tongans have for almost every tree found growing on bush and town allotments. Some species are planted purposefully, whereas others occur naturally and are protected or preserved when the secondary vegetation is cleared for

245 cropping. The most important of the tree species found on bush and town allotments on Tongatapu are listed below in two categories: valuable fruit trees and other valuable trees (for specific uses of these trees see Appendix E).A

[262] Fruit trees. Cultivated and wild fruit trees, on both bush and town allotments, are of considerable importance as supplementary food sources. In addition to the coconut palm - niu (Cocos nucifera) and the breadfruit - mei (Artocarpus altilis) described above, the major species include:

A range of citrus trees, including the orange - moli kai (Citrus sinensis); the lemon - lemani (C. limon); the mandarin-moli peli (C. reticulata); the pomelo - moli Tonga (C. maxima); the lime - laime (C. aurantifolia) ; the citron - kola (C. medica); the sour orange - moli mahi (C. aurantium) and another citrus species, the moli vaikeli, are all found on Tongatapu bush and town allotments. Native to Asia, all are post-European contact introductions, with the possible exception the pommelo (Parham 1972: 232-233; Prevost and Pitkanen; 1970: 35, 71, 101, 103). Most types are in season between February and June, except for lemons which are available in variable quantities throughout the year.

Mango - mango (Mangifera indica). The mango is native to India and the Malay Peninsula (Prevost and Pitkanen, 1970: 17) and is probably a very early

A[See Category 137, pp. 377-431--Analyst.]

introduction (Parham, 1972: 249). It is represented by a number of local varieties, the most common being mango lesi, mango kaimata, mango 'akau, and mango kalasini. The mango season generally lasts from October through February, with different varieties bearing at different times during this period.

Tahitian chestnut - ifi (Inocarpus edulis). According to Tongan legend, the Tahitian chestnut was a very early introduction from Samoa although it is probably indigenous. It is widely distributed, is represented by several varieties, and is generally in season from February through April.

Tava (Pometia pinnata). The tava, some types which are possibly native and some which were probably early introductions, is a very common tree in Tongatapu and is found growing wild and in cultivation. The most common varieties are tava kula, tava hina, tava moli, and tava toua. The season for tava is generally January and February.

Polynesian vi-apple or Polynesian plum - vi (Spondias dulcis). An early introduction, native to Malaysia and the Pacific Islands (Yuncker, 1959: 171), the Polynesian vi-apple is occasionally found on bush and town allotments. It is in season from January through March.

Two edible species of the genus Syzygium are also widely distributed on Tongatapu. These are the Malay

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apple - fekika (S. malaccense) and the rose apple - fekika palangi (S. jambos). Both native to Indomalaysia, the Malay apple was probably an early introduction (Stone, 1970: 448) and the rose apple a post European contact introduction (Parham, 1972: 200). The Malay apple is found in both the naturalized and cultivated states, whereas the rose apple is usually found in cultivation on town allotments.

The soursop - 'apele 'Initia (Annona muricata) and the sweet sop or sugar apple - 'apele Tonga (Annona squamosa) are both common. The custard apple or bullock's heart (A. reticulata) is found only rarely on town allotments in Nuku'alofa. All three species, are native to tropical America and are post-European introductions (Stone 1970: 278- 79). The fruit is generally available throughout the year, although normally most abundant from December through April.

Avocado - 'avoka (Persea americana). The avocado, native to Mexico and of post-European contact introduction, is widely distributed on bush and town allotments, and is represented by a number of varieties, the most common being the 'avoka hina and 'avoka kula. Avocados are generally in season from December through May.

Tamarind - tamaline (Tamarindus indica). Native to Africa and India and of post-European contact introduction (Stone, 1970: 315; Yuncker, 1959: 134), the tamarind is found primarily in villages on town allotments and

245 occasionally on bush allotments. It is in season from about July through October.

Guava - kuava (Psidium guajava). The guava, a relatively recent introduction of tropical American origin (Yuncker, 1959: 200), is a major species in many secondary vegetation associations and is generally considered a noxious weed. It is, however, often protected as a fruit tree on some bush and town allotments. Guava is usually in season from February through June, although it is generally available throughout the year.

A number of other fruit trees of comparatively recent introduction are also found, although infrequently, on bush and town allotments. These include: cocoa - koko (Theobroma cocoa); the macadamia nut (Macadamia tetraphylla); the cashew - apu (Anacardium occidentale); the fig - fiki kai (Ficus carica); the apple or 'apele palangi (Malus pumila); and the peach - piisi (Prunus persica).

Introduced non-fruit trees. In addition to those trees valued for their fruit, a great variety of other introduced trees have considerable value as sources of timber, firewood, traditional medicines, vegetable dyes, boundary markers, flowers for leis, as well as many other valuable products (see Appendix E for a complete listing of uses of these trees).[A] Cultivated or protected in a naturalized state on bush and town allotments, these include: red sandalwood - lopa (Adenanthera pavonina)

[A] [See Category 137, pp. 377-431--Analyst.]

245 an Indian species, now naturalized, but of possible pre-European introduction (Yuncker, 1959: 131; Parham, 1972: 104), plus the following species, most of post European contact introduction: physic nut - *fiki* (*Jatropha curcas*), frangipani - *kalosipani* (*Plumeria acuminata* and *P. rubra*) and '*olive* (*Duranta repens*), all native to tropical America (Yuncker, 1959); the perfume tree - *mohokoi* (*Cananga odorata*), the pink and white shower tree - *kasia* (*Cassia javanica*), cinnamon - *sinamoni* (*Cinnamonum zeylanicium*), and the clove - *sipaisi* (*Syzygium aromaticum*), all native to tropical Asia (Yuncker, 1959; Kuck and Tongg, 1958; Prevost and Pitkanen, 1970); the flamboyant or poinciana - '*ohai* (*Delonix regia*), native to Malagasy; (Stone, 1970: 313); the African tulip tree - *tiulipe* (*Spathodea campanulata*) native to tropical Africa (Parham, 1972; Yuncker, 1959); *kasia* (*Albizia lebbeck*), native to tropical Asia and Africa (Yuncker, 1959); kapok - *vavae* (*Ceiba petandra*), prehistoric in America, India and Africa (Stone, 1970); *sita* (*Melia azedarach*), native to China; and Norfolk Island pine - *paini* (*Araucaria excelsa*), native to Norfolk Island.

Finally, there are a small number of comparatively recent introductions, including a number of Australian species:

[318] [654] Australian gums - *pulukamu* (*Ecalyptus spp.*) and silky oak - '*oke* (*Grevillea robusta*); and the tropical American, West Indian cedar - *sita Palangi* (*Cedrela odorata*), which

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have been distributed by the Department of Agriculture as part of a reforestation scheme.

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[262]

Common Weeds and Secondary Vegetation Species

There are a great number of common weed species found throughout Tongatapu in secondary vegetation associations, many of which are eaten or are used in some beneficial way (see Appendix E)[A] as well as serving as reliable indicators of both soil fertility and the period of time that land has been under fallow. Some of these weedy species are possibly native to Tonga, but a majority of them are post-European contact introductions which have become dominants in most secondary vegetation associations (Merrill, 1945: 119). In some cases, they were deliberate introductions as ornamentals or fodder grasses, such as Lantana camara, Panicum maximum, Rhynchelytrum repens, Melinis minutiflora and Mimosa pudica (Government of Tonga, 1949: 4; Yuncker, 1959: 62). The most common weed species on Tongatapu and the assumed places of origin are listed below:

[246]
[247]

A majority of the common weeds seem to be native to tropical America; these include: te'ekosi (Ageratum conyzoides); tu'ulapepe or vavae kona (Asclepias curassavica); fisi'uli (Bidens pilosa); misimisi (Canna indica); te'epulu or tengafefeka (Cassia tora); hefa (Cenchrus echinatus); piini or piisi (Crotalaria mucronata); lau veveli (Elephantopus mollis); 'akauveli (Indigofera

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[A] [See Category 137, pp. 377-431--Analyst.]

136 *rattus*), the Norwegian rat (*Rattus norvegicus*), as well as
231 cats, cattle, horses, goats, sheep , turkeys, ducks, and
possibly insects such as the rhinoceros beetle (*Oryctes
rhinoceros*) and fruit flies were introduced after European
231 contact. Dogs, cats, pigs, cattle, horses, goats, chickens,
ducks and turkeys are presently important domesticated
136 animals. There are presently no sheep in Tonga. Rats have
become naturalized, and cats and chickens are represented
by feral stock; there were formerly also feral pigs.

The fruit bat or *peka* is nocturnal and feeds almost
exclusively on fruit such as bananas, mangoes, and papayas.
Although the fruit bat population is increasing, the
[262] problem is not considered serious. Furthermore, the *peka*
[565] provides an excellent source of protein, which, although
supposedly reserved as a delicacy for the nobility, is
eaten occasionally by commoners.

[241] Rats constitute a major nuisance and cause consider-
●245 able damage to a variety of crops. Owing to the economic
136 importance of copra, most of the research concerning rat
damage has been focused on its effect on coconut production.
Estimates of loss in coconuts have ranged up to 80 percent.
Recent studies, however, indicate that this is a gross
overestimation and that loss of yield in any individual
stand of coconut palms is rarely over 10 percent (Pierce,
1971b: personal communication). *Rattus rattus* comprised
80 percent of all rats trapped in coconut palms during the

245 136 recent survey (Pierce, 1971a: 4).

136 241 *Rattus exulans* and *R. norvegicus* seem to be less arboreal and, according to a recent survey by Agricultural Department personnel, account for most of the rodent damage to ground crops. The common field mouse (*Mus musculus*) may also be present and responsible for crop damage (Pierce, 1971b: 1). Results of this survey indicate that rodent damage to watermelons often reaches 30 to 50 percent of the total crop; damage to maize is commonly 30 to 60 percent with 90 percent losses in severe cases; and peanuts, sweet potatoes, and cassava all sustain some damage. *Rattus norvegicus* seemed to be more common than *R. exulans* in most habitats. (Pierce, 1971a: 2-4) The author has also observed severe rat damage to all of these crops as well as to papaya and pumpkins.

Native birds are responsible for high losses of crops such as corn, strawberries, papayas, mangoes, and *tava* (*Pometia pinnata*). Two species which are particularly bad pests are the banded rail (*Rallus philippensis*) and the 136 purple swamp hen (*Porphyrio porphyrio*). Birds also seem 137 to be the major dispersal mechanism for *Carica papaya* and *Cordyline terminalis* as well as weedy species such as 136 *Lantana camara* and *Psidium guajava*. The native barn owl (*Tyto alba*) probably has some limiting effect on the rat 136 population. Although the combined effect of domesticated 241 and feral stock, bats, rats, and birds is considerable, 136 241 the effect of the invertebrate fauna on the agricultural system is probably of greater significance.

136 245 Two of the most destructive pests are the rhinoceros beetle (*Oryctes rhinoceros*) and the coconut stick insect (*Graeffea crouani*), which have been responsible for substantial losses in coconut production. The rhinoceros beetle, which was first discovered on Tongatapu in December, 1961, possibly carried by man from Vava'u, has been the object of extensive, although as yet unsuccessful, control programs. The coconut palm is also affected by other insects including the coconut flat moth (*Agonoxena spp*), and the coconut leaf miner (*Promecotheca spp.*).

Considerable damage to bananas is caused by the banana scab moth (*Nicoleia octasema*), the banana rust thrips (*Chaetanophothrips orchidii*), the nematode (*Rodopholus similis*), fruit flies (*Atherigona orientalis* and *Dacus faciatus*), and indirectly by a species of aphid (*Pentalonia nigronervosa*) which is responsible for the spread of bunchy-
136 241 [439] toptop virus (O'Connor, 1969). Fruit flies are also a problem in production of tomatoes and bell peppers, and have made Tongan citrus fruit unacceptable for the New Zealand market (Johansson, 1971: personal communication). Other invertebrates, such as leaf miners, moths, spider mites, and weevils, also cause damage to crops throughout Tongatapu.

423 427 The holders of non-Royal hereditary estates have a number of rights, including the receipt of rent from all [651] bush allotment holders on their respective estates. In addition, they receive 90 percent of the rent from every lease on their estate (10 percent goes to the Crown). They also have the power to approve all allotments and leases granted on their land; can refuse to grant an allotment to a resident of another estate, even if the wife resides on their estate; and can reserve portions of their estate for their own private use or that of their family of their [681] heirs. The holder of any hereditary estate may not dispossess any holder of a bush allotment or lease except [656] for contravention of the law. The holder of an hereditary estate may, however, refuse to renew a lease or refuse to grant a bush allotment, although his decision may be overruled by the Minister of Lands and the Cabinet.

Tenure to individual tax and town allotments is not secured until they are surveyed and registered with fees ranging from T$11 to $18 depending on the size of the allotment (Wylie, 1967:647-649). 423 427 681 245 Thereafter, tenure is secure unless the holder is convicted for a felony; is declared legally insane; fails to pay his annual rent of T$0.80; does not maintain the allotment in a reasonable state of cultivation (each holder of a bush allotment is required to plant 200 coconut palms and keep them in a reasonable state of cultivation); uses the land or crops as security ;

423 illegally allows an alien to reside on the land; or
427 abandons the allotment for over two years. The tenure of
[245] leasehold land (including permits, sub-leases, and transfers)
[681] is also subject to the payment of a registration and surveyor's fees relative to the size of the parcel of land.

423 Enforcement and Administration

647 The Land Act of 1927 provides for the enforcement and
[698] administration of the land laws. Provision is made for the establishment of the Land Court, the appointment of a Minister of Lands, and Land and Survey Department Office in Nuku'alofa.

423 Present Distribution and Effectiveness of the Land Tenure System

The existence of a legal code does not necessarily guarantee enforcement of these laws. Consequently, it is necessary to look at the present distribution of types of land tenure on Tongatapu to determine the effect of the law on the agricultural system.

423 As of 1971, 39 hereditary estates or *tofi'a* had been
565 granted to chiefs or *matapules* (Maude, 1971:112). Of these 23 have part or all of their estates on Tongatapu (Figure 9) and 16 have their entire estates on other islands. The combined area of the 23 estates on Tongatapu is approximately 42,400 acres (17,200 hectares) (see Appendix F[A] for a breakdown of the estates by title, location on Tongatapu, and approximate areas). Including the King's and the Royal Family's estates, the combined acreage of all

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[A] [See Category 423, pp. 432-433--Analyst.]

423 Survey of 1957, the estate holder has allowed a relatively
high percentage of the allotments to be registered.

The area with the lowest proportion of registered
allotments is around Fatumu and Have'uliku, where sub-
division has not been completed and tenure to many parcels
is on a customary basis. There seems to be little signifi-
cant difference in the percentage of households having only
temporary tenure, except for Kolonga, where the percentage
[311] was 35. Kolonga is one of the major banana growing areas,
[245] as well as being well-organized on a village basis for
production of cash crops. Likewise, out of seven allotments
[427] which were rented, five were in the Kolonga district, where
successful local enterpreneurs have rented allotments from
other villagers.

[592] In summary, although the number of allotments in Tonga
is insufficient, most households have some access to land,
241 either permanently or temporarily. Futhermore, although
311 strictly forbidden by law, renting land to those who are
423 landless or industrious enough to farm more land often
427 intensifies utilization of the land that is available.
241 Because of varying permanency of tenure, different kinds of
311 cropping, ranging from almost purely subsistence gardening
423 to purely commercial agriculture, occur throughout the
mosaic-like pattern of over 5,000 bush allotments. The
permanency of tenure of town allotments is also often
reflected in the degree to which trees and long-term crops

434 Table 22. Continued.

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Table cloth	1	Fertilizer	1

439 The fungus, Auricularia polytricha, which is exported
137 to Hong Kong, is classified as an agricultural product by
824 the Tongan Government, and although most of it comes from
the island of 'Eua, some is still found during rainy periods
on dead logs in forested areas of bush allotments on
Tongatapu.

439 At present there is a concerted effort being made by
179 the Agricultural Department and the Tonga Commodity Boards
652 to diversify and increase agricultural exports in order to
179 stabilize the economy. These efforts have increased
241 production of garden vegetables, pineapples, watermelons,
root crops,and, more recently, vanilla. ~~Nevertheless,~~
439 the major export crops continue to be coconuts and bananas.
245

Unfortunately, the market for copra is highly unstable,
and both crops are susceptible to disease, pests, hurricanes,
[505] and periodic droughts. In the case of bananas, exports
depend on unreliable shipping services to New Zealand.
Nevertheless,coconuts and bananas are still the major
commercial crops found on the traditional bush allotment.
Consequently it is important to have some background on the
production of these crops.

Copra and Other Coconut Products

Prior to World War II independent traders throughout

[TEXT CONTINUED ON PAGE 156]

439 Tonga purchased undried coconut kernel from individual
245 farmers and sold it, after drying at the main export center.
The traders were paid a per ton commission and consequently
worried about quantity rather than quality. Little care
was taken in drying the fresh coconut kernels, and soon
Tongan copra had the reputation of being the worst in the
South Seas (Tonga Copra Board, 1969b : 1). Consequently
Tongan copra was difficult to market and production
245 remained at a very low level. In 1942, a co-operative
439 marketing organization, the Tonga Copra Board, was estab-
655 lished and given sole right to export copra. Quality was
improved through rigid controls over drying, establishment
of a strict grading system at the time of purchase, and a
policy of trying to obtain the highest possible returns for
245 the individual producers. The industry received further
439 help from the British Ministry of Food which offered an
F.O.B. price and arranged shipping, which was very scarce
in the early days (Tonga Copra Board, 1969b: 2). The
quality of Tongan copra has improved considerably, and by
1947 the production of copra had reached over 14,000 tons
per year (Table 24). Production and value of Tongan copra
continued to increase until the mid-1950's. Since that time,
production has fluctuated with decreases owing to hurricanes,
drought, poor copra prices and the conversion of coconuts
into other products. Nevertheless, copra has continued to
be Tonga's number one export except during 1967 and 1968

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Table 24. Tonga and Tongatapu copra production and exports 1942-1970 (Tongatapu figures through 1966 include 'Eua production.

Year	Total Production (1000 Tons)		Total Export Products (1000 Tons)	Value to Producers ($T1000)	F.O.B. Value ($T1000)
	Tongatapu	Tonga	Tonga	Tonga	Tonga
1942	-	-	5	-	154
1943	2	8	7	203	267
1944	5	11	11	345	483
1945	5	10	8	336	374
1946	6	13	8	522	345
1947	7	15	15	865	1,396
1948	7	15	15	1,117	1,628
1949	7	15	14	1,348	1,628
1950	8	16	17	1,331	2,017
1951	9	17	19	1,669	2,542
1952	8	17	17	2,086	2,661
1953	8	15	13	1,730	2,048
1954	8	15	14	1,878	2,448
1955	9	21	21	2,400	3,501
1956	11	22	19	2,199	2,769
1957	11	22	27	2,042	3,739
1958	9	16	14	1,391	1,999

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Table 24 continued.

Year	Total Production (1000 Tons)		Total Export Products (1000 Tons)	Valueto Producers ($T1000)	F.O.B. Value ($T1000)
	Tongatapu	Tonga	Tonga	Tonga	Tonga
1959	8	16	16	2,088	3,116
1960	9	17	16	1,841	2,754
1961	11	16	17	1,231	2,239
1962	8	10	9	726	1,095
1963	8	11	10	1,004	1,355
1964	6	10	11	988	1,582
1965	5	9	7	1,116	1,131
1966	5	9	12	884	1,791
1967	5	11	11	1,105	1,662
1968	3	8	8	876	1,399
1969	5	12	-	1,079	-
1970	5	8	-	839	-

Sources: Tonga Copra Board, 1969b:5-6; Tonga Copra Board records.

245 when bananas surpassed it. In 1969, copra regained its
439 position as the leading export. At present, the bulk of Tongan copra is shipped to continental Europe; some shipments have gone to Japan, Colombia, and Venezuela (Tonga Copra Board records).

In addition to copra, there are a number of other coconut products which are exported commercially: desiccated
[258] coconut, coir products, and whole nuts. Production of desiccated coconut (sliced and quick-dried) for overseas shipment commenced in 1963 at Haveluloto, just outside Nuku'alofa. As of 1971, all coconuts used in its production were obtained from Tongatapu growers who sold them to the Copra Board at permanent buying stations throughout Tongatapu. Desiccated coconut is a source of increasing income to Tonga and its farmers (Table 25). It is generally exported to New Zealand, Australia, the United Kingdom, or Fiji. In 1965, the Copra Board began exporting whole coconuts to Australia and New Zealand. The quantity is small, however, compared to that used for desiccated coconut.

288 In 1963, the Copra Board started a coir fiber industry
655 to utilize the leftover husks from the production of desiccated coconut. The major products were rope, twine, door mats, floor runners, and various types of brushes.
[439] Unfortunately, exports proved unprofitable and the Board has continued only limited production for local consumption.

439 **Table 25. Bulk desiccated coconut production and exports 1963-1970.**

● 245

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Year	Production (Tons)	Exports (Tons)	Total F.O.B. Value $T1000
1963	402	402	91
1964	766	743	171
1965	933	884	245
1966	1036	922	259
1967	1099	1235	319
1968	1191	1059	379
1969	1283	1076	294
1970	1345	1538	459

Sources: Tonga Copra Board Records

245 Production of coconut oil was also attempted and proved unsuccessful.

Such attempts to expand coconut related industries
245 encountered major obstacles. Increased copra production,
435 for example, is discouraged by the instability of copra
prices. The monthly price structure in Tonga is based on the average of Philippines' quotations made by the Spot Fixing Committee of the London Copra Association. Tonga has virtually no control over the price structure, which over the years has been very unstable. For example in December

245 1971 prices paid to Tongan farmers for first grade copra
435 were T$70 per ton compared to $T115 in January 1971 (Tonga
245 Copra Board Records). Similar difficulties are also
435 experienced by farmers selling whole coconuts to the Copra
655 Board. From March to May 1971, the Copra Board paid growers
three cents per whole coconut. From June to December, the
price was only 1.2 cents per nut (Tonga Copra Board Records).
245 The factors responsible for these prices are not understood
655 by the average Tongan grower and often attributed to poor
[435] management by the Copra Board. Internal problems within the
[829] Board and financial losses of a construction company
established by the Board have helped destroy much of the
confidence that growers had in the Board.

245 As a result of these economic factors in combination
with problems with pests and disease, there was in 1971
little interest in improvement and expansion of coconut
cultivation. The palms are generally neglected, with weeds
and brush around the bases; traditional burning practices
harm the bases of the trees; crops are planted too close to
the trees; and a large proportion of the trees are declin-
ing in yield owing to senility (Liyanage, 1971: personal
245 communication). In order to revitalize the coconut
654 industry, a Coconut Replanting Scheme was established in
1966 and a Coconut Subsidy Scheme was begun in 1967.

[457] The Coconut Replanting Scheme (C.R.S.), which was made
possible through a grant from the British Ministry of

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654
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Overseas Development, set up nurseries throughout the Kingdom to provide high quality coconut seedlings for interested farmers. The following services and subsidies are also provided by the C.R.S. as incentives to coconut replanting: 1) machinery is provided for clearing and ploughing land in preparation for replanting; 2) $T2.00 to $T4,50 per acre is paid to growers who clear their own land under the direction of the C.R.S.; 3) fertilizer is provided; and 4) $T2.00 per acre is paid to growers who maintain their new plantings to the standards set by the C.R.S. A measure of the success of the work of the C.R.S. is that during the year 1970, a total of 3,876 acres (1568 hectares) were replanted in the Kingdom, 1,919 acres (777 hectares) of which was on Tongatapu (Coconut Replanting Scheme 1971:1).

[651]

The Coconut Subsidy Scheme encourages use of fertilizer to improve yields of pre-existing coconut palms. The scheme is financed by Copra Board funds obtained through levies on copra production and provides fertilizer free of cost for two years in rehabilitated areas, for four years in replanted areas, and at one-half cost under the general subsidy scheme (Tonga Copra Board, 1969b:14-15).

Although these programs have had some effect in revitalizing the industry, the general attitude of most Tongan farmers seems to be that the palms are indestructable and will continue to produce sufficient yields regardless of horticultural practices. Very few farmers qualify for the

245 654 subsidies for adequate maintenance of the young trees, and many new palms have been killed as a result of burning, [244] competition by weeds, or trampling by horses or cattle. The fertilizer is often diverted to other crops, such as watermelons or European vegetables. The palms generally are poorly cared for and many allotments are not planted with [262] sufficient palms to obtain maximum yields. Nevertheless, the fact that most allotments do have mature coconut palms, and some have replanted palms, reflects their importance not only as a source of cash but also as a major staple item in the Tongan diet.

241 Bananas and Other Commercial Agricultural Exports

439 The other export crop, bananas, along with commercial watermelons, pineapples, and garden vegetables, have also become integral parts of the cropping sequences on bush [655] allotments. In 1940, bananas, watermelons, pineapples, and a number of other products were declared "commodities" under the Agricultural Organization Act and have since been marketed only through the Tonga Produce Board (Wylie, 1967: 1557-1563).

245 439 Bananas became an important export in the first decade of the century. In 1908, over 100,000 cases were shipped to New Zealand at a value of $T28,000. In 1909, however, New Zealand trade restrictions caused a considerable decline in the export of bananas. This decline lasted until 1931 when a satisfactory trade agreement was reached (Naval Intelli-

245 gence Division, 1944:81). The banana industry has since
439 experienced numerous problems, and there has been
considerable fluctuation in exports (Table 26). The drop in
245 production in 1963 was a result of cyclone damage, while the
731 drop in 1952 resulted from a combination of drought in late
132 1951 and high winds in January 1952 (Tonga Produce Board,
1953 and 1964:1).

245 In addition to climatic variables, the banana industry
439 has been susceptible to a great variety of problems,
[655] including shipping strikes, low prices to growers due to
excessive overhead costs of the Produce Board, restrictive
quota system, poor quality packing by growers, and, most
recently, disease, In 1951, as a result of waterfront
strike in New Zealand, no vessels arrived during March and
there was an estimated export loss of 20,000 to 30,000 cases
(Tonga Produce Board, 1952).

In 1961 and 1962, banana quotas were reduced by New
Zealand, owing to balance of payments problems (Maude, 1965:
150). Trial shipments were then made to Japan in an effort
to open new markets and in 1964 four shipments were
[655] consigned to Japan. In many cases, farmers accused the
Produce Board of favoritism in assigning quotas. In 1966,
owing to floods in the Fiji Islands and a hurricane in
Samoa, these two areas could not fulfill their New Zealand
quotas and Tonga was free to ship as many bananas as
possible. This eliminated the attractiveness of shipping to

245 Japan and provided the stimulus for the great increase in
439 production. During 1967 and 1968 bananas surpassed copra
as the number one export and many Tongan farmers planted
large portions of their bush allotments with bananas in
order to share in the considerable profits that were being
made.

245 Unfortunately, in 1967 black-leaf-streak fungal disease
137 (*Mycosphaerella fijiensis*) and bunchy-top virus led to a
drastic reduction of banana production in Vava'u and
Ha'apai, especially during the warmer months (Government of
[242] Tonga, 1968a:4-5). By 1968, despite regular spraying
programs conducted by the Department of Agriculture, bunchy
top and black-leaf-streak broke out during the summer and
[136] early fall on Tongatapu. Also a factor in the incipient
decline in 1968 was a root nematode (*Radopholus similis*).
[439] (Government of Tonga, 1969a:6). The black-leaf-streak was
worse in 1969 and banana exports from Tongatapu dropped by
245 approximately 60 percent. Production again decreased in
1970 and 1971 and many farmers have become disenchanted and
given up banana cultivation.

245 In an attempt to combat declining banana production,
654 the Tonga Produce Board, in co-operation with the Department
[457] of Agriculture and subsidized by Fruit Distributors Ltd.of
New Zealand (the firm which buys all of Tonga's present
[439] banana exports), approved a Banana Rehabilitation Scheme in
1971. This required growers to plant one acre or more of at

[TEXT CONTINUED ON PAGE 167]

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Table 26. Banana exports from Tongatapu and the Kingdom of Tonga, 1951 to 1971.

	Tongatapu	Tonga	Tonga
	No. of Cases* (1000)	No. of Cases* (1000)	Value ($T1000)
1951	65	74	137
1952	22	29	55
1953	76	86	168
1954	87	115	233
1955	104	133	285
1956	154	184	384
1957	152	158	372
1958	69	70	172
1959	157	171	429
1960	171	183	456
1961	114	119	294
1962	121	153	383
1963	68	93	227
1964	114	147	371
1965	248	315	994
1966	361	455	1,342
1967	507	607	1,797
1968	475	536	1,735

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Table 26 continued.

	Tongatapu	Tonga	Tonga
	No. of Cases* (1000)	No. of Cases* (1000)	Value ($T1000)
1969	191	209	680
1970	121	143	464
1971	81	118	358

*The size and dimension of banana cases have changed a number of times between 1951 and 1971.

Source: Tonga Produce Board Records.

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[242]
[136]

least 500 plants with no intercropping, to control weeds to a reasonable standard, to practice desuckering and leaf-trimming, and to destroy bunchy-top affected plants. The Agriculture Department's responsibilities were to apply fertilizer at a rate of two pounds per plant per annum, to spray to control black-leaf-streak; to supply two percent DDT powder for control of the banana scab moth (Nacoleia octasema), and to keep a register of approved growers (Government of Tonga, 1972b:5-6). Despite these strong measures, in late 1971 most farmers were still reluctant to plant bananas and very few bush allotments had healthy banana plantations.

245 banana plantations. Nevertheless, the banana industry [439] continues to be a major source of cash income to the Tongan farmer, and the 8 1/4 acre bush allotments continue to be the major suppliers of bananas to the Produce Board for shipment to New Zealand.

313 One important effect of the increase in banana production in the 1960's was the need for locally produced banana cases which put considerable pressure on the timber resources of Tongatapu as well as 'Eua and Vava'u. In fact, by 1968, the timber resources on Tongatapu had been reduced to such an extent that milling ceased and was shifted to 'Eua (Government of Tonga, 1969a:16).

241 439 655 There has been a continuing attempt by the Tonga Produce Board and the Tongan Government to diversify export crops and broaden Tonga's agricultural base. In the case of watermelons, pineapples, plantains, tomatoes, and bell peppers, which are exported through the Produce Board, the results have been quite encouraging. 241 439 [441] Some crops are also presently being shipped through independent marketing agencies to New Zealand, Fiji, Samoa, and the United States. These include mangoes, tomatoes, bell peppers, egg plant, green beans, ginger, yams, taro, and sugar cane. The export values for these products for the five year period from 1967 to 1971 are included in Table 23.^A [441] Most of these independent exporters are individuals or church or missionary societies, holding leasehold rights to large tracts of land

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^A [See Category 439, pp. 152-155--Analyst.]

231 232 mares to upgrade the standard of work horses in the Kingdom.
654 Owing to the rapid elimination of native forest species
on Tongatapu, as a result of the need for firewood and
654 timber for banana shooks and other purposes, the Agriculture
● 245 Department has a limited reforestation program, which
318 includes nurseries at Sopu on Tongatapu and on 'Eua and the
[313] issuance of seedlings to interested allotment holders. The
major species which have been planted by individual allotment holders have been Casuarina equisitefolia, Eucalyptus spp., and Grevillea robusta, all natives of Australia, and the tropical American Cedrela odorata. The only major reforestation project in the Kingdom has been conducted on 'Eua, where 200 acres of Pinus caribaea have been successfully established (Government of Tonga, 1971c:26). On Tongatapu, there are only limited cases where farmers have planted introduced forest species on their allotments.

241 In conclusion, the overall effect of the recent
231 introductions of new techniques and plant and animal
179 material on the Tongan agricultural system seems to have
241 been minimal. This is in spite of considerable subsidies
231 offered by government agencies and a recently expanded
654 agricultural extension program, yearly agriculture shows,
207 a system of "Rural Broadcasting" designed to improve agri-
179 cultural education over the radio, the establishment of a
Government Agricultural Training Center at the Experimental
Farm in Vaini, and a continued overall effort by the Agri-

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● 245

Table 28. Key to important tree species for maps of sample bush allotments (Figures 14-42). Allotment numbers refer to sample numbers used during the survey.

Symbol	Scientific Name	English Name	Tongan Name
Aa	Artocarpus altilis	breadfruit	mei
Am	Aleurites moluccana	candlenut	tuitui
Amu	Annona muricata	soursop	'apele 'Initia
Ap	Adenanthera pavonina	bead tree	lopa
Az	Alphitonia zizyphoides		toi
Ba	Barringtonia asiatica	poison fish tree	futu
Bc	Bruguiera conjugata	mangrove	tongo
Bj	Bischofia javanica		koka
Br	Burkella richii		kau
C	Citrus medica	citron	kola
Ci	Calophyllum inophyllum		feta'u
Cl	Citrus limon	lemon	lemani
Cm	Citrus maxima	pomelo	moli Tonga
Cma	Cerbera manghas		toto
Co	Cananga odorata	perfume tree	mohokoi
Cod	Cedrela odorata	silky oak	sita Palangi
Cp	Ceiba pentandra	kapok	vavae
Cr	Citrus reticulata	mandarin	molipeli
Cs	Citrus sinensis	orange	moli kai
Df	Diospyros ferrea		kanume
Dfo	Dysoxylon forsteri		mo'ota

Table 28. Continued.

102
241
311
137
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Symbol	Scientific Name	English Name	Tongan Name
Dl	Diospyros laterifolia		mapa
Ea	Excoecaria agallocha		feta'anu
Ef	Ellatostachys falcata		ngatata
Eo	Ervatamia orientalis		te'ete'emanu
Et	Elaeocarpus tonganus		ma'ama'alava
Ev	Erythrina variegata	coral tree	ngatae
Fb	Fagraea berteriana		pua Tonga
Fo	Ficus obliqua		'ovava
Fs	Ficus scabra		masi'ata
Ga	Gyrocarpus americanus		puko
Gc	Grewia crenata		fo'ui
Gf	Garunga floribunda		manaui
Gr	Glochidion ramiflorum		malolo, masikoka
Gro	Grevillea robusta	silky oak	'oke
Gs	Garcinia sessilis		heilala
Hl	Heritiera littoralis		ifi tahi
Hn	Homolanthus nutans		malamala'afonua
Ho	Hernandia ovigera		fotulona
Ht	Hibiscus tiliaceus	hibiscus	kaute
Ie	Inocarpus edulis	Tahitian chestnut	ifi
Jc	Jatropha curcas	physic nut	fiki
Ll	Lumnitzera littorea		hangale

Table 28. Continued

102
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311
137
245

Symbol	Scientific Name	English Name	Tongan Name
Ma	*Melia azedarach*		*sita*
Mc	*Morinda citrifolia*		*nonu*
Mh	*Macaranga harveyana*		*loupata*
Mhy	*Myristica hypargyraea*	nutmeg	*kotone*
Mi	*Mangifera indica*	mango	*mango*
Mm	*Mertya macrophylla*		*kulukulu*
Oo	*Ochrosia oppositifolia*		*fao*
Pa	*Persea americana*	avocado	*'avoka*
Pac	*Plumeria acuminata*	frangipani	*kalosipani*
Par	*Pittosporum arborescens*		*masi'aukava*
Pg	*Psidium guajava*	guava	*kuava*
Pgl	*Parinarium glaberrimum*		*pipi, pipi failolo*
Pp	*Pometia pinnata*		*tava*
Ppe	*Prunus persica*	peach	*piisi*
Pt	*Pandanus tectorius*	screw pine	*fa*
Rm	*Rhizophora mangle* or *R. mucronata*	mangrove	*tongo, tongolei*
Rt	*Rhus taitensis*		*tavahi*
Scl	*Syzygium clusiaefolium*		*fekika vao*
Sc	*Syzygium corynocarpium*		*hehea*

Table 28. Continued

102
241
311
137
● 245

Symbol	Scientific Name	English Name	Tongan Name
Sd	*Spondias dulcis*		vi
Sj	*Syzygium jambos*	rose apple	fekika Palangi
Sm	*Syzygium malaccense*	malay apple	fekika kai
Sy	*Santalum yasi*	sandlewood	ahi
Ta	*Tournefortia argentea*	beach heliotrope	touhuni
Tc	*Terminalia catappa*	Indian almond	telie
Ts	*Tarenna sumbucina*		manonu
Va	*Vavaea amicorum*		ahi vao
Xg	*Xylocarpus granatum*	cannonball tree	lekileki

Figure 14. SAMPLE BUSH ALLOTMENT NO. 2

Location: Hofoa Area: 8.25 Acres

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241
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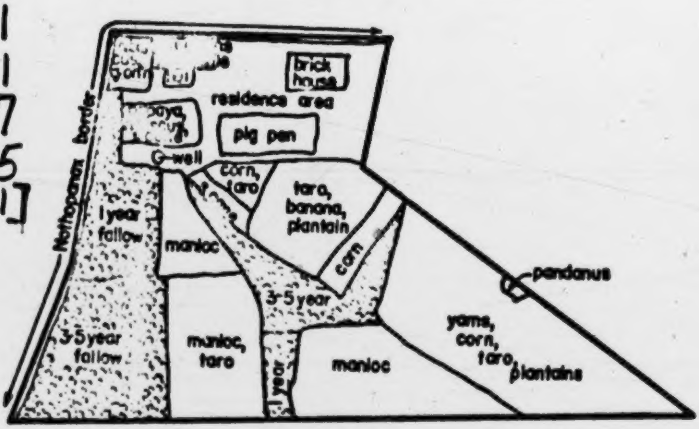
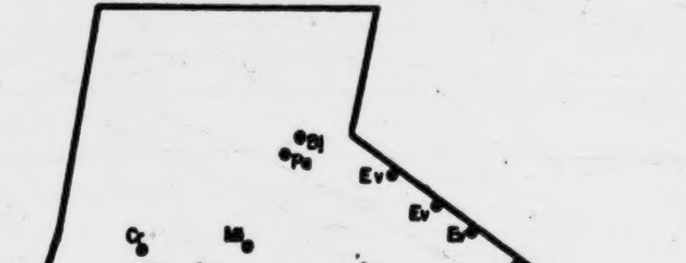
[351]


brick house
residence area
pig pen
corn
G-well
corn, taro
taro, banana, plantain
corn
1 year fallow
manioc
3-5 year
3-5 year fallow
manioc, taro
year
manioc
pandanus
yams, corn, taro, plantains
Nattaganon border

Distribution of Major Crops


Bj
Pe
Ev
Ev
Ev
Cr
Mi
Cr
Cr
Pg
Am
Ev
Bj
Bj
Ev
Hr
Bj
Ev
Bj
Bj
Ev

Distribution of Important Tree Species

(Coconut Coverage: 75% Mature Palms; No Replanted Palms.)

Figure 15. SAMPLE BUSH ALLOTMENT NO. 3

Location: Hofoa Area: 8.26 Acres

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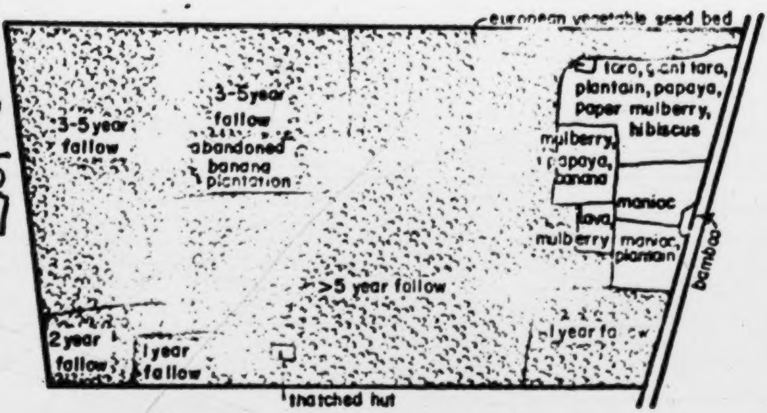
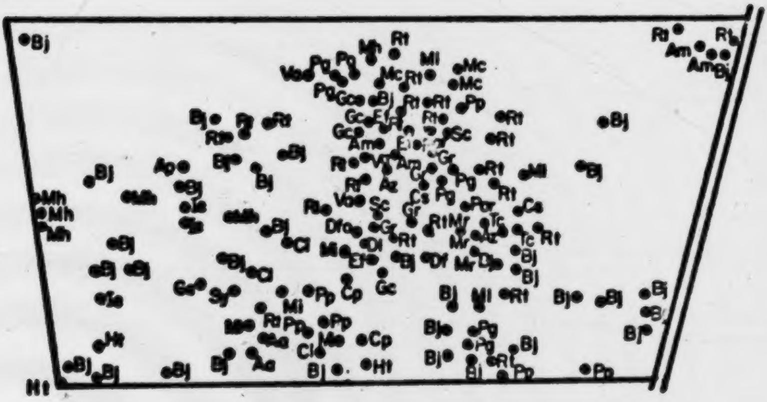
[351]


european vegetable seed bed
taro, giant taro, plantain, papaya, paper mulberry, hibiscus
mulberry, papaya, banana
manioc
taro
mulberry
manioc, plantain
bamboo
3-5 year fallow
3-5 year fallow abandoned banana plantation
>5 year fallow
2 year fallow
1 year fallow
1 year fallow
thatched hut

Distribution of Major Crops


Bj
Rt
Mh
Mi
Mc
Am
Pp
Gc
Sc
Cs
Pg
Ht
Cp
Cl
Az

Distribution of Important Tree Species

(Coconut Coverage: 75% Mature Palms; No Replanted Palms.)

Figure 16. SAMPLE BUSH ALLOTMENT NO. 6

Location: Haveluloto Area: 6.41 Acres

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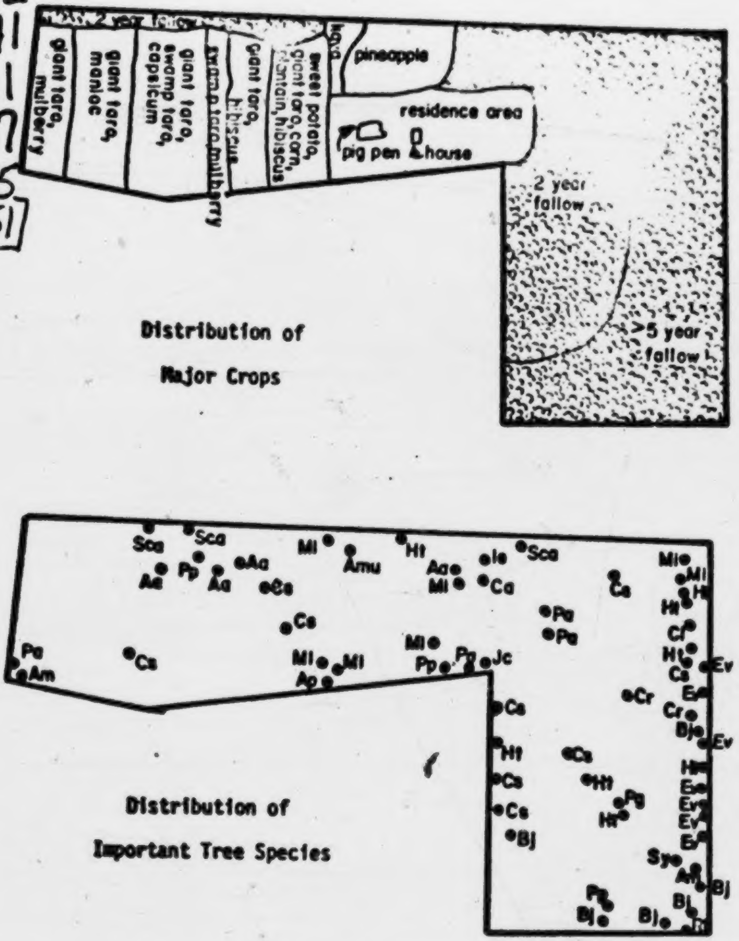
137
● 245
[351]


2 year fallow
giant taro, mulberry
giant taro, manioc
giant taro, swamp taro, capsicum
giant taro, swamp taro, mulberry
giant taro, hibiscus
sweet potato, giant taro, corn, plantain, hibiscus
kava
pineapple
residence area
pig pen
house
2 year fallow
>5 year fallow
Sca
Sca
Ae
Pp
Aa
Aa
Cs
Ml
Amu
Ht
Aa
Ml
Ie
Ca
Sca
Cs
Ml
Ml
Ht
Pa
Pa
Cs
Cf
Ht
Ev
Cs
Pa
Am
Cs
Ml
Ml
Ap
Ml
Pp
Pg
Jc
Cs
Cr
Cr
Bj
Ev
Ht
Cs
Cs
Ht
Cs
Pg
Ht
Bj
Ht
Ev
Ev
Ev
Sye
Am
Bj
Pg
Bj
Bj
Bl

Distribution of Major Crops

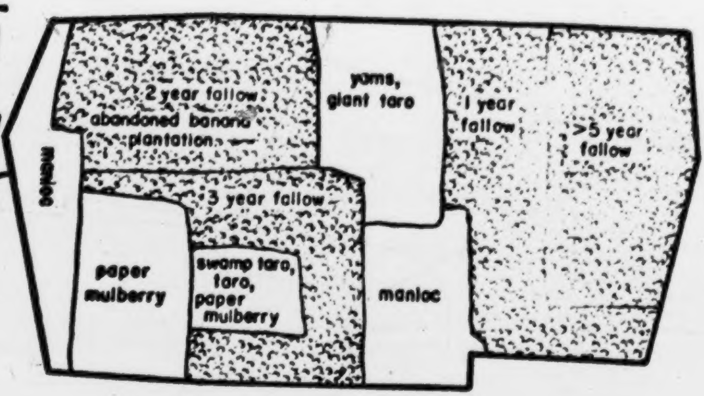
Distribution of Important Tree Species

(Coconut Coverage: 50% Mature Palms; No Replanted Palms.)

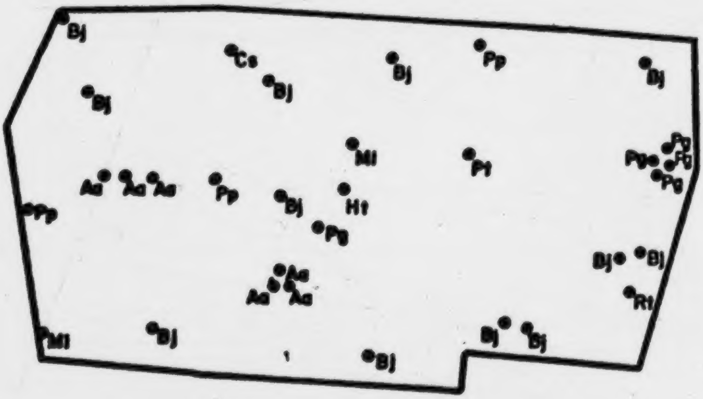
Figure 17. SAMPLE BUSH ALLOTMENT NO. 10

Location: Ma'ufanga Area: 8.36 Acres

102
241
311
137
● 245


2 year fallow
abandoned banana plantation
yams, giant taro
1 year fallow
>5 year fallow
manioc
3 year fallow
paper mulberry
swamp taro, taro, paper mulberry
manioc

Distribution of Major Crops'


Bj
Cs
Bj
Bj
Pp
Bj
Bj
Ml
Pt
Pg
Pg
Pg
Pg
Aa
Aa
Aa
Pp
Bj
Ht
Pp
Pg
Bj
Bj
Aa
Aa
Aa
Rt
Ml
Bj
Bj
Bj
Bj

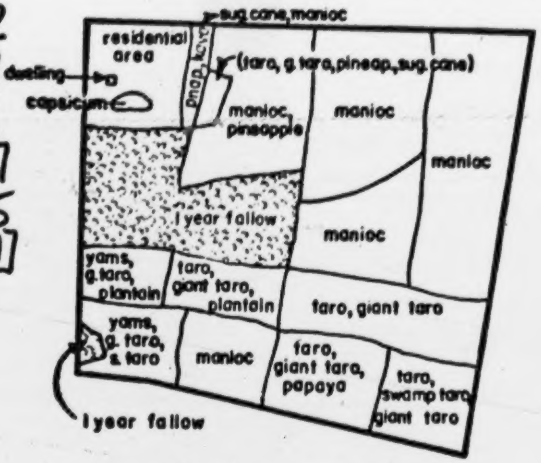
Distribution of Important Tree Species

(Coconut Coverage: 50% Mature Palms; No Replanted Palms.)

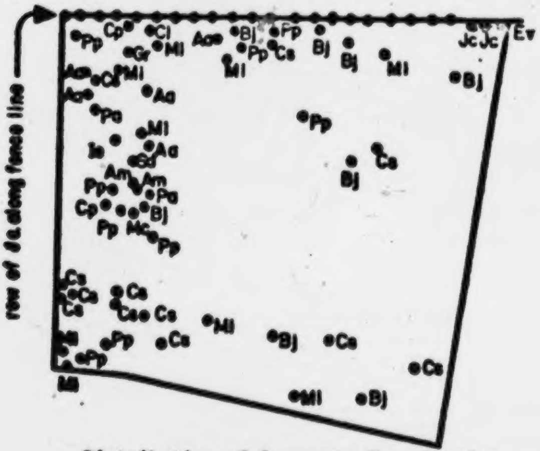
Figure 18. SAMPLE BUSH ALLOTMENT NO. 12

Location: Hofoa Area: 4.76 Acres

102
241
311
137
● 245
[351]


sug.cane,manioc
residential area
dwelling
capsicum
pinap, kava
(taro, g.taro,pineap.,sug.cane)
manioc, pineapple
manioc
manioc
manioc
1 year fallow
yams, g.taro, plantain
taro, giant taro, plantain
taro, giant taro
yams, g. taro, s. taro
manioc
taro, giant taro, papaya
taro, swamp taro, giant taro
1 year fallow

Distribution of Major Crops

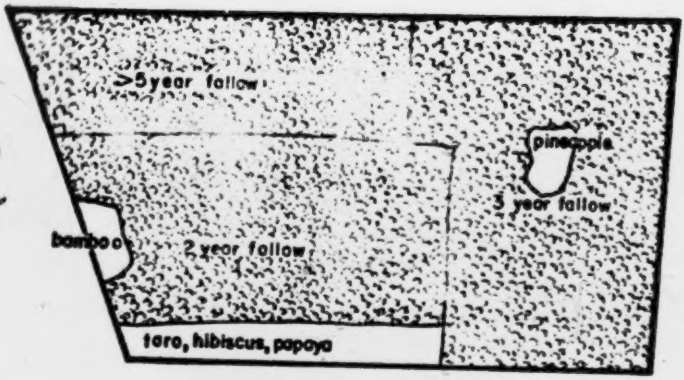

row of Ja along fence line
Pp
Cp
Cl
Gr
Ml
Ac
Bj
Pp
Ml
Fp
Cs
Bj
Bj
Ml
Jc Jc
Ev
Bj
Ac
Cs
Ml
Ac
Pa
Pp
Ml
Ia
Ac
Gd
Am
Am
Cs
Bj
Pp
Pa
Cp
Bj
Pp
Mc
Pp
Cs
Cs
Cs
Cs
Cs
Cs
Ml
Pp
Cs
Bj
Cs
Pp
Cs
Ml
Bj
Ml

Distribution of Important Tree Species
(Coconut Coverage: 75% Mature Palms; 10% Replanted Palms.)

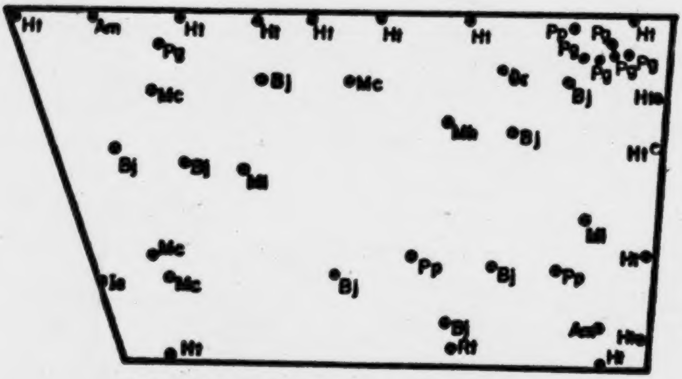
Figure 19. SAMPLE BUSH ALLOTMENT NO. 15

Location: Liahona Area: 8.25 Acres

102
241
311
137
● 245


>5year fallow
pineapple
3 year fallow
bamboo
2 year fallow
taro, hibiscus, papaya

Distribution of Major Crops


Ht
Am
Ht
Ht
Ht
Ht
Ht
Pp
Pg
Ht
Pg
Pg
Pg
Pg
Pg
Bj
Mc
Mc
Bj
Bj
Mb
Bj
Ht
Bj
Bj
Mi
Mi
Mc
Ht
Mc
Bj
Pp
Bj
Pp
Bj
Ht
Ht
Ht

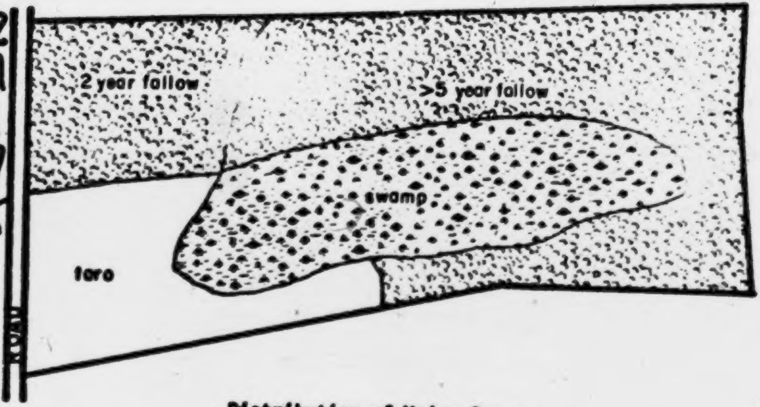
Distribution of Important Tree Species

(Coconut Coverage: 50% Mature Palms; 5% Replanted Palms.)

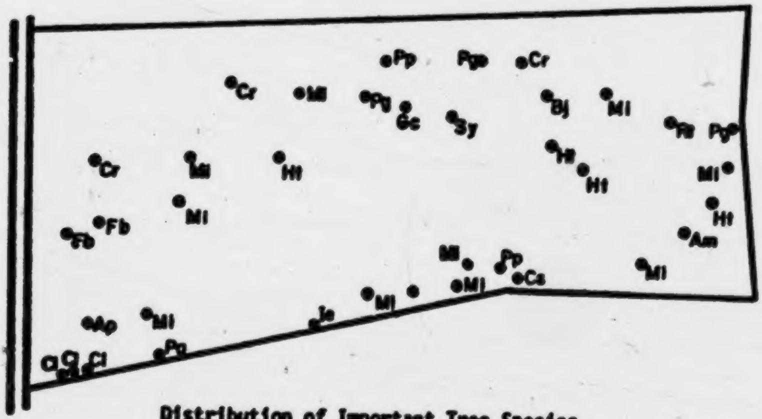
Figure 20. SAMPLE BUSH ALLOTMENT NO. 19

Location: Fatai Area: 8.27 Acres

102
241
311
137
245


2 year fallow
>5 year fallow
swamp
taro

Distribution of Major Crops


Pp
Pgp
Cr
Cr
Ml
Pg
Gc
Sy
Bj
Ml
Ht
Pg
Cr
Ml
Ht
Ht
Ht
Ml
Ml
Ht
Fb
Fb
Am
Ml
Pp
Ml
Cs
Ml
Ml
Ml
Ap
Ml
Io
Pg
Cl
Cl
Cl

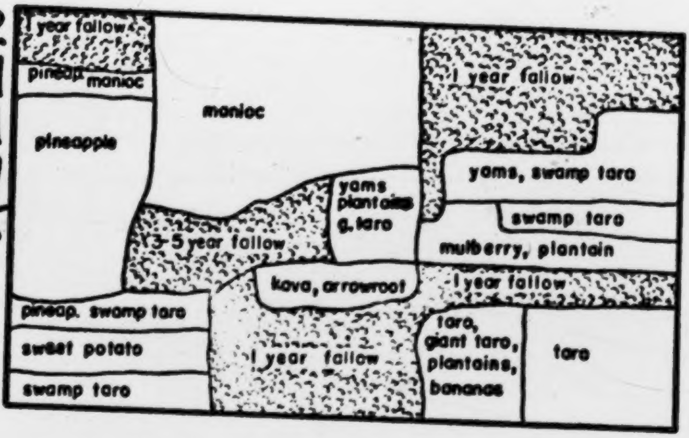
Distribution of Important Tree Species

(Coconut Coverage: No Coconuts.)

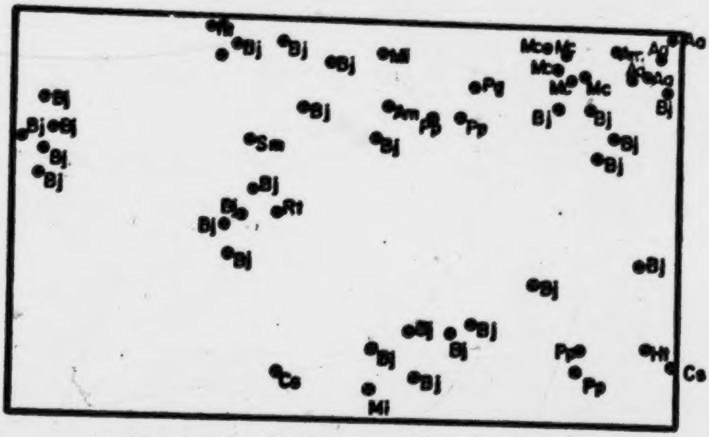
Figure 21. **SAMPLE BUSH ALLOTMENT NO. 21**

Location: Lakepa **Area: 8.25 Acres**

102
241
311
137
● 245


I year fallow
pineap. manioc
pineapple
manioc
I year fallow
yams, swamp taro
swamp taro
mulberry, plantain
yams
plantains
g. taro
3-5 year fallow
kava, arrowroot
I year fallow
pineap. swamp taro
sweet potato
swamp taro
I year fallow
taro, giant taro, plantains, bananas
taro

Distribution of Major Crops

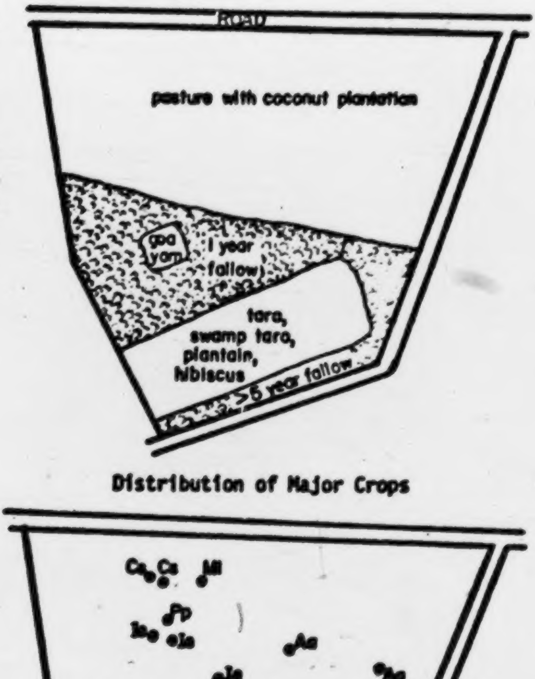

Bj
Mi
Mce Mc
Ag
Pg
Am
Pp
Sm
Rt
Cs
Hi
Mi

Distribution if Important Tree Species
(Coconut Coverage: 25% Mature Palms; 75% Replanted Palms.)

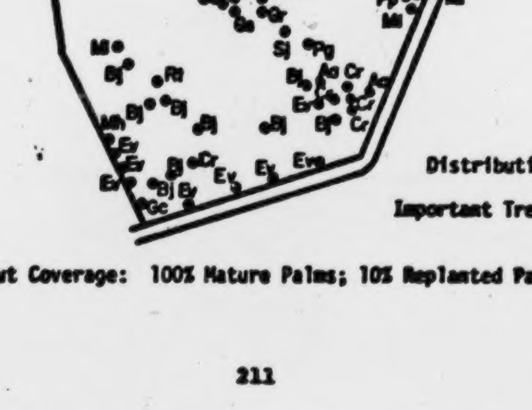
Figure 22. SAMPLE BUSH ALLOTMENT NO. 27

Location: Fe'ui Area: 5.01 Acres

102
241
311
137
● 245


ROAD
pasture with coconut plantation
goa yam
1 year fallow
taro, swamp taro, plantain, hibiscus
>6 year fallow

Distribution of Major Crops


Cs
Cs
Mi
Pp
Ie
Ie
Ac
Ie
Ac
Pp
Gs
Sc
Cr
Gs
Gr
Gs
Pp
Mi
Mi
Sj
Pg
Mi
Bj
Rt
Bj
Ac
Cr
Ac
Bj
Bj
Ev
Cr
Cr
Mh
Bj
Bj
Bj
Bj
Ev
Ev
Bj
Cr
Ev
Ev
Ev
Ev
Bj
Ev
Gc

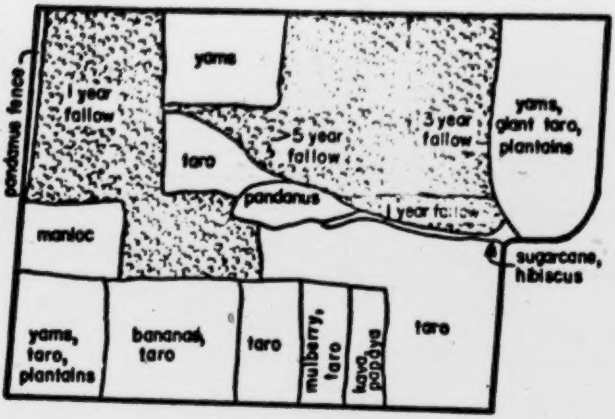
Distribution of Important Tree Species

(Coconut Coverage: 100% Mature Palms; 10% Replanted Palms.)

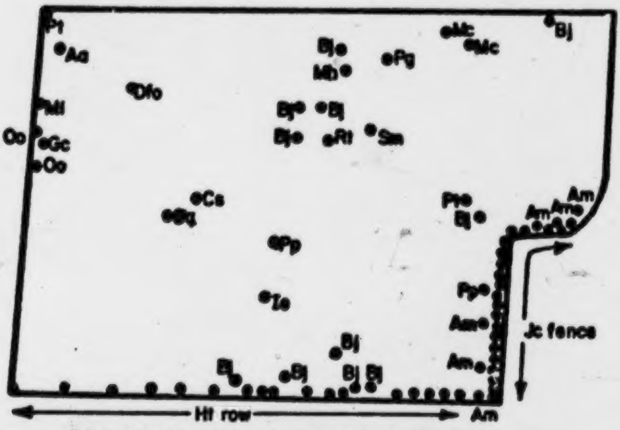
Figure 23. SAMPLE BUSH ALLOTMENT NO. 28

Location: Kolovai Area: 12.00 Acres

102
241
311
137
● 245


yams
1 year fallow
pandanus fence
>5 year fallow
3 year fallow
yams, giant taro, plantains
taro
pandanus
1 year fallow
manioc
sugarcane, hibiscus
yams, taro, plantains
bananas, taro
taro
mulberry, taro
kava, papaya
taro

Distribution of Major Crops

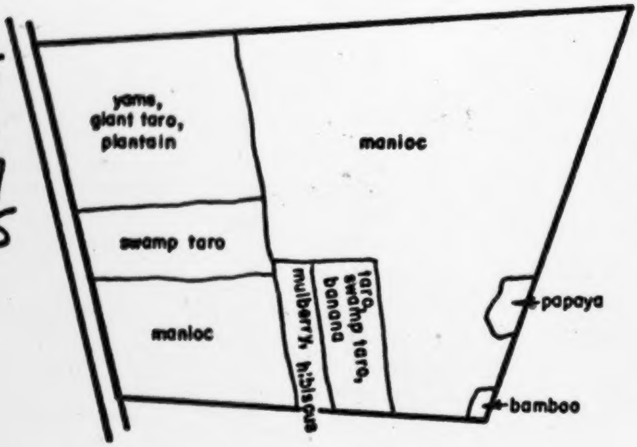

Pt
Aa
Dfo
Ml
Oo
Gc
Oo
Bj
Mb
Pg
Mc
Mc
Bj
Bj
Bj
Bj
Rt
Sm
Cs
Bq
Pp
Ie
Pp
Bj
Am
Am
Am
Pp
Am
Am
Bj
Bj
Bj
Bj
Bj
Jc fence
Ht row
Am

Distribution of Important Tree Species
(Coconut Coverage: 50% Mature Palms; No Replanted Palms.)

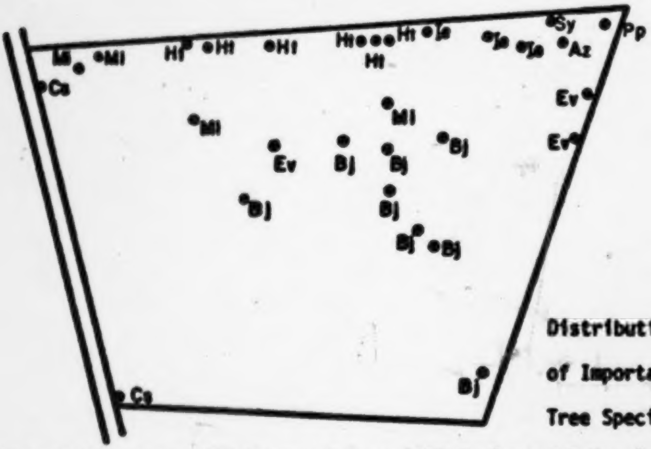
Figure 24. SAMPLE BUSH ALLOTMENT NO. 30

Location: 'Ahau   Area: 3.05 Acres

102
241
311
137
245


yams,
giant taro,
plantain
manioc
swamp taro
manioc
mulberry, hibiscus
taro, swamp taro, banana
papaya
bamboo

Distribution of Major Crops


Ml
Ml
Cs
Ht
Ht
Ht
Ht
Ht
Ht
Je
Je
Je
Sy
Pp
Az
Ev
Ev
Ml
Ml
Ev
Bj
Bj
Bj
Bj
Bj
Bj
Bj
Bj
Cs

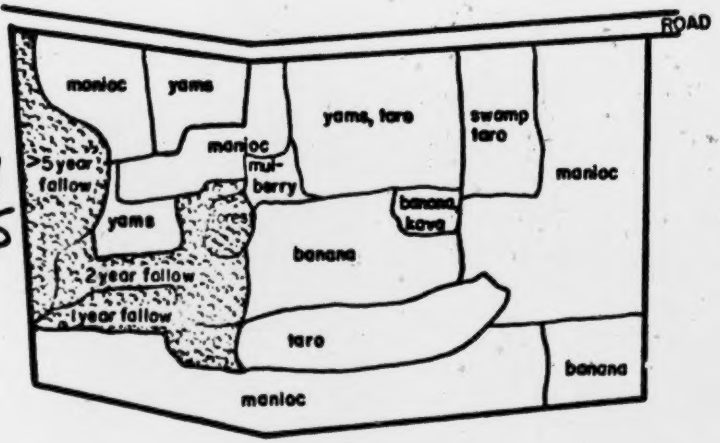
Distribution of Important Tree Species

(Coconut Coverage: 25% Mature Palms; 100% Replanted Palms.)

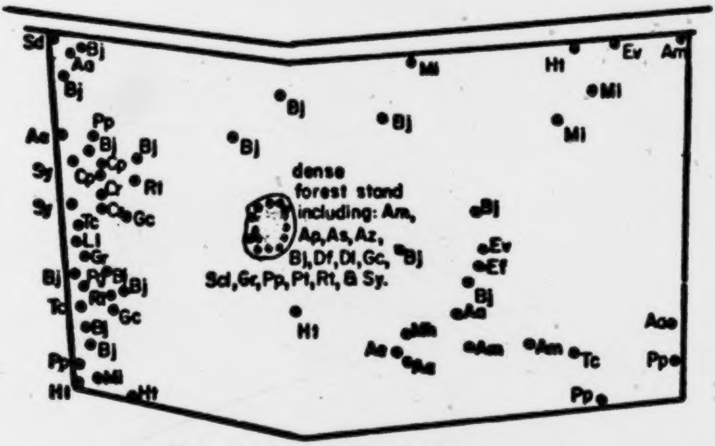
102
241
311
137
245

Figure 25. SAMPLE BUSH ALLOTMENT NO. 31

Location: Ha'akili Area: 8.30 Acres


ROAD
manioc
yams
manioc
mul-berry
yams, taro
swamp taro
manioc
>5year fallow
yams
forest
banana, kava
banana
2year fallow
1year fallow
taro
banana
manioc

Distribution of Major Crops

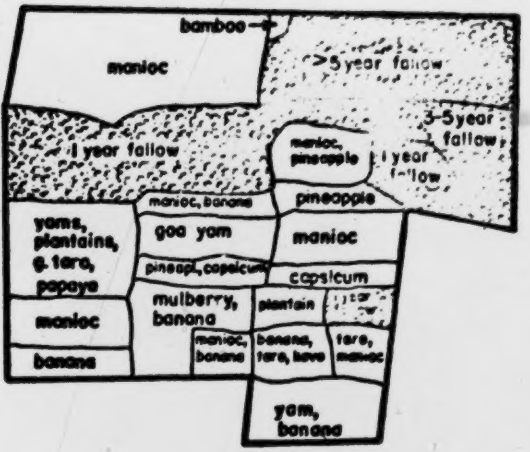

Sd
Bj
Aa
Bj
Mi
Ht
Ev
Am
Mi
Bj
Bj
Mi
Pp
Ae
Bj
Bj
Bj
Sy
Cp
Cp
Cr
Rt
Sy
Ci
Gc
Tc
Li
Gr
dense forest stand including: Am, Ap, As, Az, Bj, Df, Dl, Gc, Sd, Gr, Pp, Pt, Rt, & Sy.
Bj
Ev
Ef
Bj
Bj
Bj
Pt
Bl
Tc
Rt
Gc
Bj
Bj
Ht
Aa
Mh
Ae
Aa
Am
Am
Tc
Aae
Pp
Pp
Mi
Ht
Ht
Pp

Distribution of Tree Species
(Coconut Coverage: 75% Mature Palms; 75% Replanted Palms.)

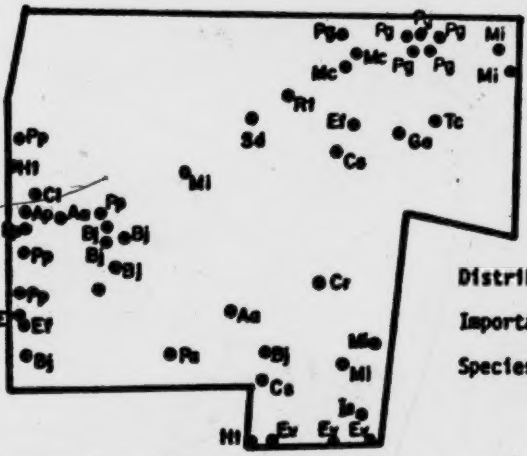
Figure 26. SAMPLE BUSH ALLOTMENT NO. 34

Location: Neiafu Area: 6.22 Acres

102
241
311
137
● 245


bamboo
manioc
>5 year fallow
3-5 year fallow
1 year fallow
manioc, pineapple
1 year fallow
manioc, banana
pineapple
yams, plantains, g. taro, papaya
goa yam
manioc
pineapl, capsicum
capsicum
mulberry, banana
plantain
1 year fallow
manioc
banana
manioc, banana
banana, taro, kava
taro, manioc
yam, banana

Distribution of Major Crops


Pg
Pg
Pg
Pg
Pg
Mi
Mi
Mc
Mc
Ri
Sd
Ef
Tc
Go
Cs
Pp
Hi
Mi
Ci
Ap
Aa
Pp
Bj
Bj
Bj
Bj
Pp
Pp
Ef
Ef
Bj
Cr
Aa
Ps
Bj
Mi
Mi
Cs
Is
Hi
Ev
Ev
Ev

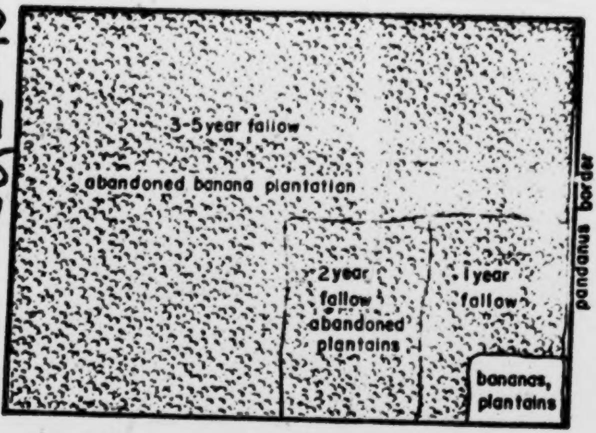
Distribution of Important Tree Species

(Coconut Coverage: 75% Mature Palms; 25% Replanted Palms.)

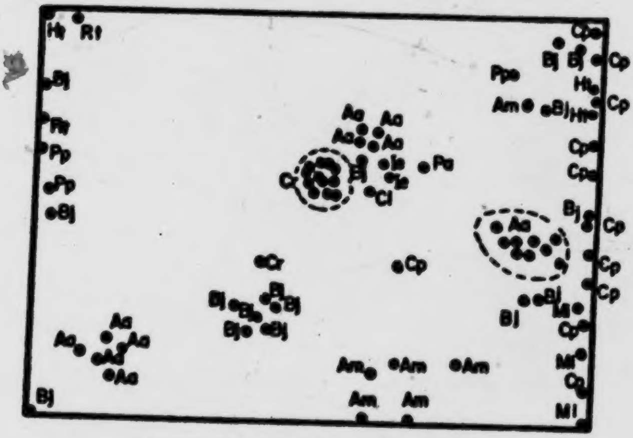
Figure 27. SAMPLE BUSH ALLOTMENT NO. 38

Location: Houma Area: 8.26 Acres

102
311
241
● 245
137


3-5 year fallow
abandoned banana plantation
2 year fallow abandoned plantains
1 year fallow
bananas, plantains
pandanus border

Distribution of Major Crops


Ht
Rt
Bj
Rr
Pp
Pp
Bj
Aa
Aa
Aa
Aa
Cr
Bj
Ie
Ie
Pa
Cl
Pp
Am
Bj
Ht
Cp
Bj
Bj
Cp
Ht
Cp
Cp
Cp
Bj
Cp
Aa
Cp
Cp
Cp
Cr
Bj
Bj
Bj
Bj
Bj
Aa
Aa
Aa
Aa
Aa
Am
Am
Am
Am
Am
Bj
Bj
Ml
Cp
Ml
Cp
Ml
Bj

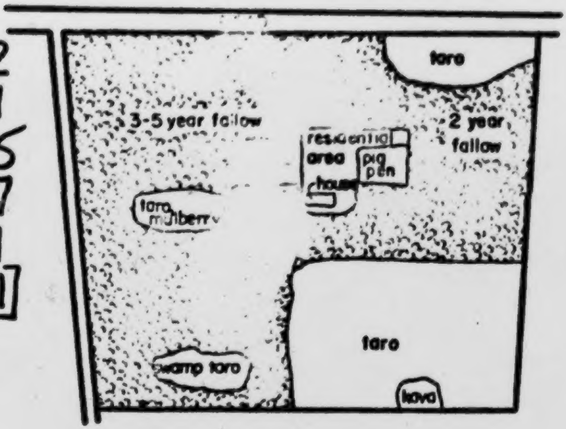
Distribution of Important Tree Species

(Coconut Coverage: 10% Mature Palms; 5% Replanted Palms.)

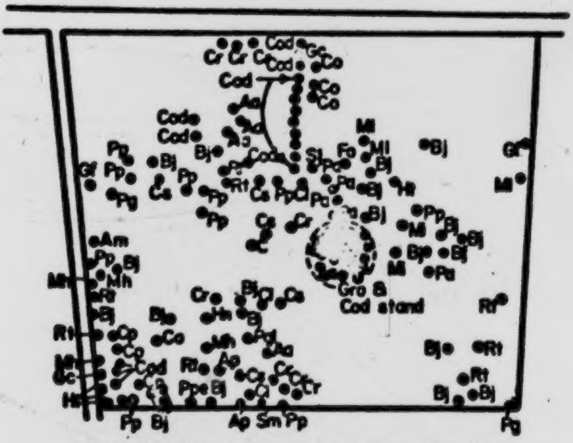
102
241
● 245
137
311
[351]

Figure 28. SAMPLE BUSH ALLOTMENT NO. 39

Location: Houma Area: 8.26 Acres


taro
3-5 year fallow
2 year fallow
residential area
pig pen
house
taro mulberry
swamp taro
taro
kava

Distribution of Major Crops

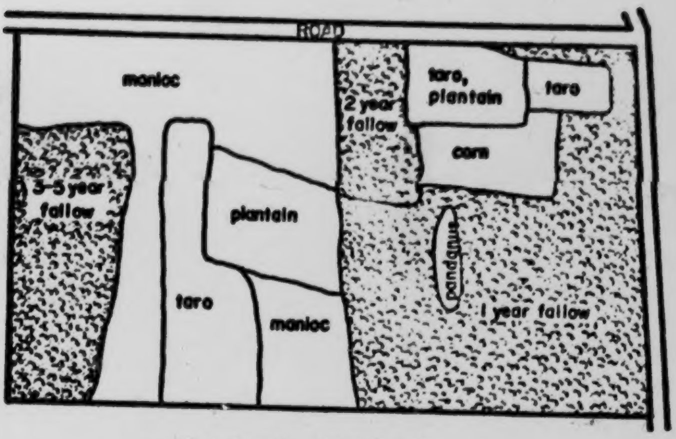

Cod
Co
Cr
Code
Aa
Bj
Pp
Gf
Pg
Cs
Rt
Sl
Pa
Fo
Ml
Ht
Am
Mh
Cp
Ci
Ap
Sm
Gro & Cod stand

Distribution of Important Tree Species
(Coconut Coverage: 75% Mature Palms; 10% Replanted Palms.)

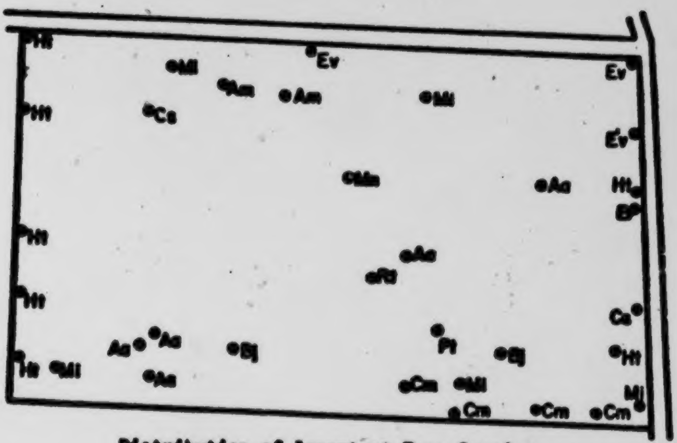
Figure 29. SAMPLE BUSH ALLOTMENT NO. 45

Location: Tokomololo **Area:** 8.40 Acres

102
241
● 245
311
137


ROAD
manioc
taro, plantain
taro
2 year fallow
corn
3-5 year fallow
plantain
pandanus
taro
manioc
1 year fallow

Distribution of Major Crops


Ht
Mi
Ev
Ev
Am
Am
Mi
Ht
Cs
Ev
Aa
Ht
Ht
Aa
Ht
Cs
Aa
Aa
Bj
Pt
Bj
Ht
Ht
Mi
Aa
Cm
Mi
Mi
Cm
Cm
Cm

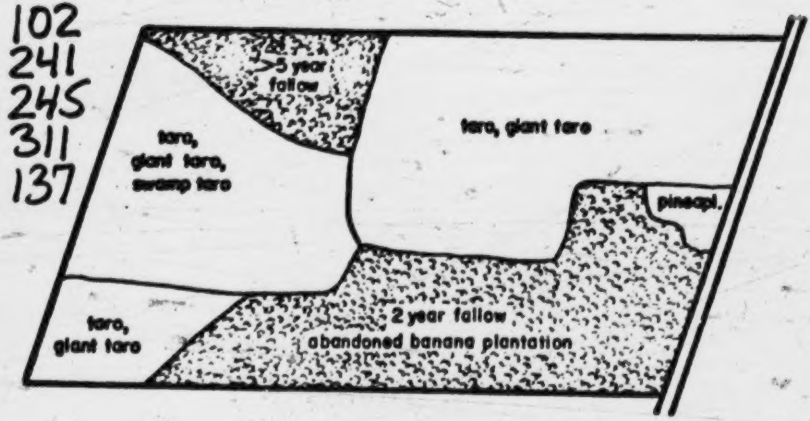
Distribution of Important Tree Species

(Coconut Coverage: 75% Mature Palms; 50% Replanted Palms.)

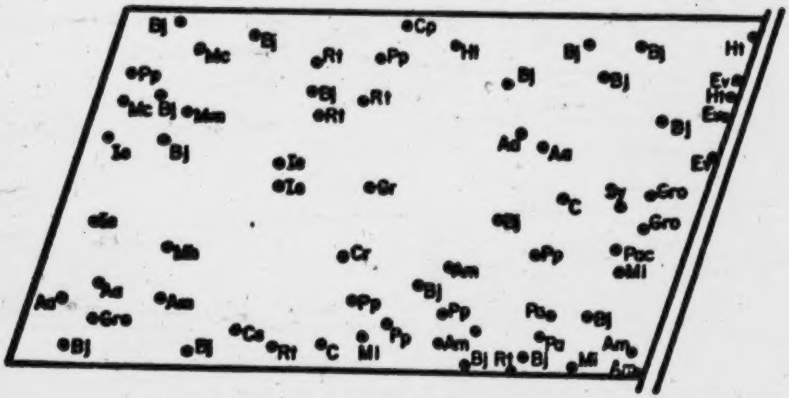
102
241
245
311
137

Figure 30. SAMPLE BUSH ALLOTMENT NO. 46

Location: Utulau Area: 8.25 Acres


>5 year fallow
taro, giant taro
taro, giant taro, swamp taro
pineapl.
taro, giant taro
2 year fallow
abandoned banana plantation

Distribution of Major Crops


Bj
Cp
Bj
Mc
Rt
Pp
Ht
Bj
Bj
Ht
Pp
Bj
Bj
Mc
Bj
Mm
Bj
Rt
Rt
Ev
Ht
Ev
Bj
Ie
Bj
Ad
Aa
Ie
Ie
Gr
Ev
C
Sy
Gro
Bj
Gro
Mh
Cr
Pp
Pac
Am
Mi
Aa
Bj
Ad
Am
Pp
Gro
Pp
Pa
Bj
Cs
Pp
Am
Pa
Am
Bj
Bj
Rt
C
Mi
Bj
Rt
Bj
Mi
Am

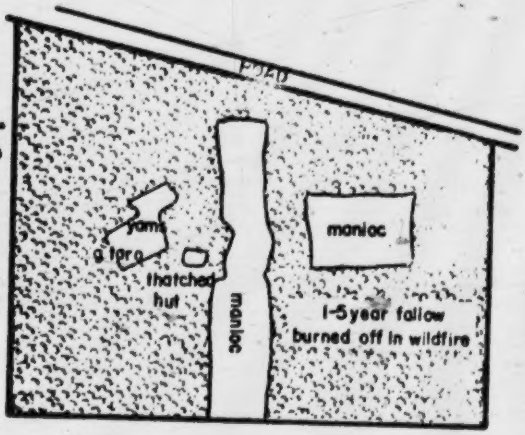
Distribution of Important Tree Species

(Coconut Coverage: 75% Mature Palms; 5% Replanted Palms.)

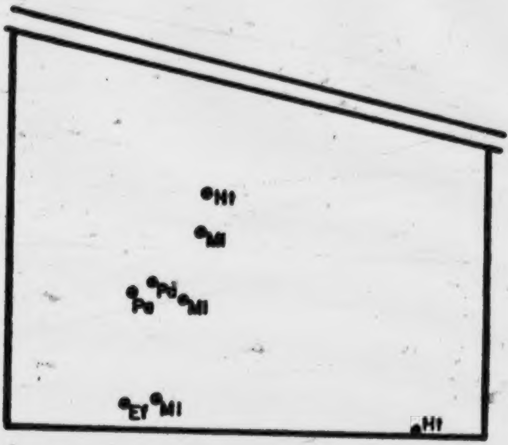
Figure 31. SAMPLE BUSH ALLOTMENT NO. 53

Location: Vaini Area: 8.30 Acres

102
241
245
311
137
[351]


road
yams
a taro
thatched hut
manioc
manioc
1-5year fallow
burned off in wildfire

Distribution of Major Crops

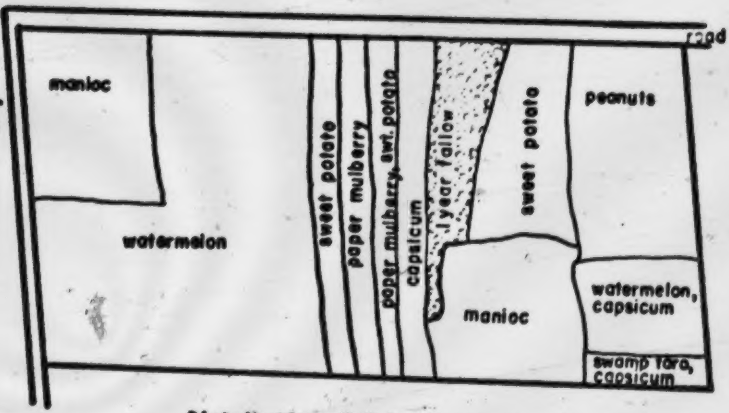

Ht
Mi
Pd
Pe
Mi
Et
Mi
Ht

Distribution of Important Tree Species
(Coconut Coverage: 25% Mature Palms; 10% Replanted Palms.)

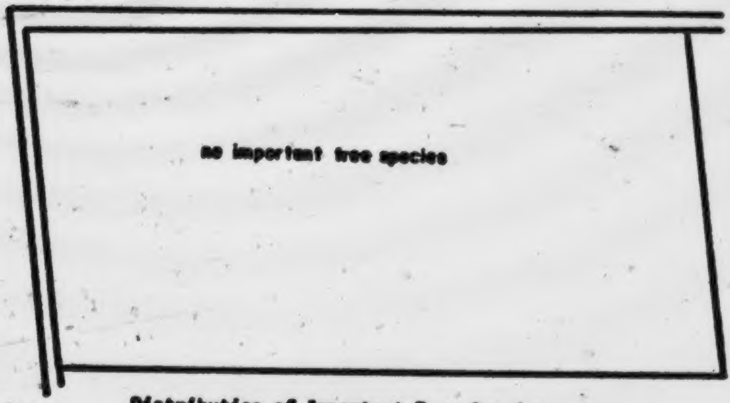
Figure 32. SAMPLE BUSH ALLOTMENT NO. 56

Location: Vaini **Area:** 8.25 Acres

102
241
● 245
311
137


road
manioc
watermelon
sweet potato
paper mulberry
paper mulberry, swt. potato
capsicum
1 year fallow
sweet potato
peanuts
manioc
watermelon, capsicum
swamp taro, capsicum

Distribution of Major Crops


no important tree species

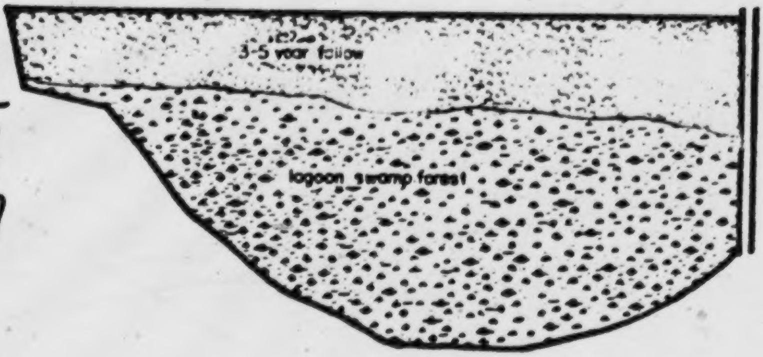
Distribution of Important Tree Species

(Coconut Coverage: No Mature Palms; 100% Replanted Palms.)

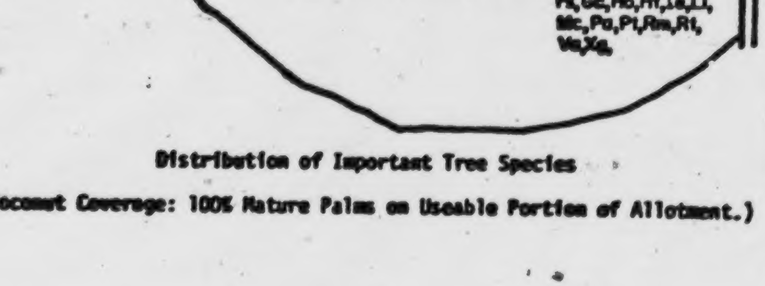
Figure 33. SAMPLE BUSH ALLOTMENT NO. 60

Location: Folaha Area: 6.28 Acres

102
241
● 245
311
137


3-5 year fallow
lagoon swamp forest

Distribution of Major Crops


eCo
lagoon swamp forest, including: Az,Bc,Ci,Cmo,Eo,
Fs,Gc,Ho,Ht,Ie,Li,
Mc,Po,Pt,Rm,Rt,
Vo,Xg.

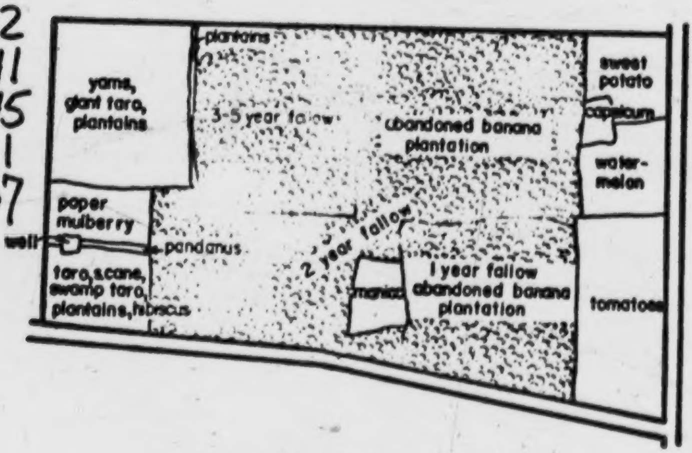
Distribution of Important Tree Species

(Coconut Coverage: 100% Mature Palms on Useable Portion of Allotment.)

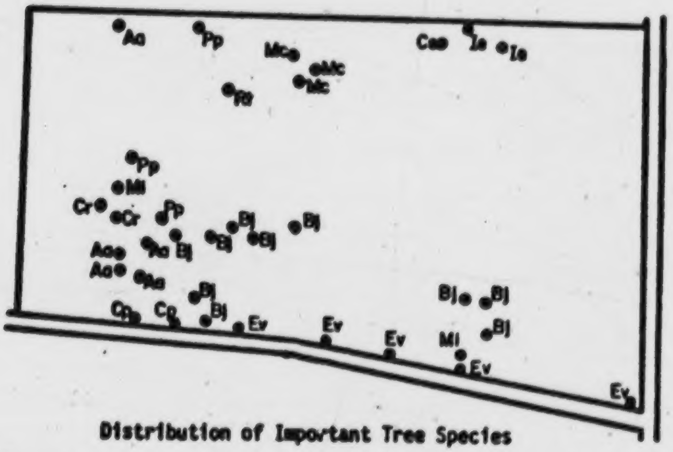
Figure 34: SAMPLE BUSH ALLOTMENT NO. 62

Location: Longoteme Area: 8.25 Acres

102
241
245
311
137


plantains
yams, giant taro, plantains
3-5 year fallow
abandoned banana plantation
sweet potato
capsicum
water-melon
paper mulberry
well
pandanus
2 year fallow
taro, s.cane, swamp taro, plantains, hibiscus
manioc
1 year fallow abandoned banana plantation
tomatoes

Distribution of Major Crops


Aa
Pp
Mc
Mc
Mc
Fa
Ca
Ie
Ie
Pp
Mi
Cr
Cr
Pp
Bj
Bj
Bj
Bj
Bj
Aa
Aa
Aa
Aa
Bj
Bj
Cn
Cn
Ev
Ev
Ev
Bj
Bj
Mi
Bj
Ev
Ev

Distribution of Important Tree Species

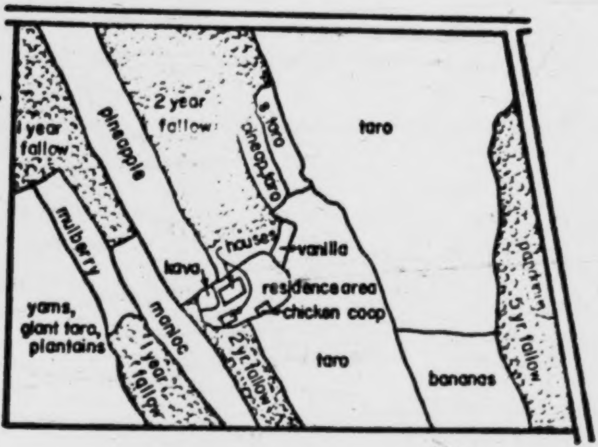
(Coconut Coverage: 75% Mature Palms; 25% Replanted Palms.)

88: Thaman K-5 (1967-1973) 1978 OU9 Tonga OU9
Tongatapu

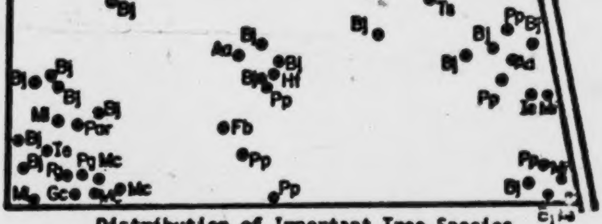
Figure 35. SAMPLE BUSH ALLOTMENT NO. 67

Location: Vaini 'uta Area: 8.25 Acres

102
241
● 245
311
137
[351]


1 year fallow
pineapple
2 year fallow
& taro
pineapple/taro
taro
mulberry
houses
vanilla
kava
residence area
chicken coop
yams, giant taro, plantains
manioc
1 year fallow
2 yr. fallow
taro
bananas
pandanus
5 yr. fallow

Distribution of Major Crops

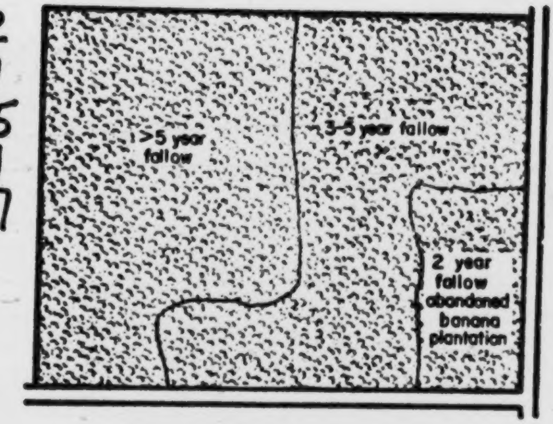

Am
Bj
Mh
Bj
Cs
Pp
Mi
Ce
Aa
Mn
Ts
Pp
Aa
Hi
Mi
Par
Te
Pg
Mc
Gc
Fb
Pp
Cj

Distribution of Important Tree Species
(Coconut Coverage: 100% Mature Palms; No Replanted Palms.)

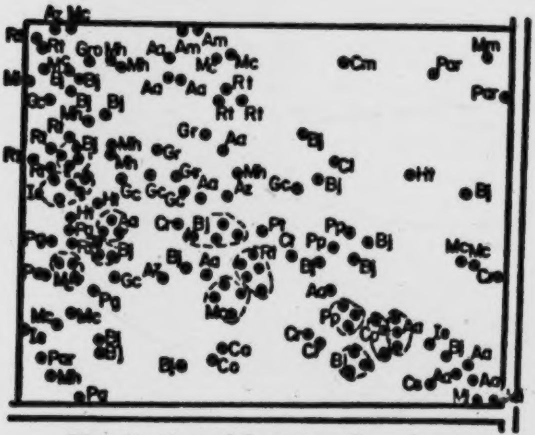
Figure 36. SAMPLE BUSH ALLOTMENT NO. 69

Location: Fua'amotu Area: 8.25 Acres

102
241
245
311
137


1>5 year fallow
3-5 year fallow
2 year fallow abandoned banana plantation

Distribution of Major Crops

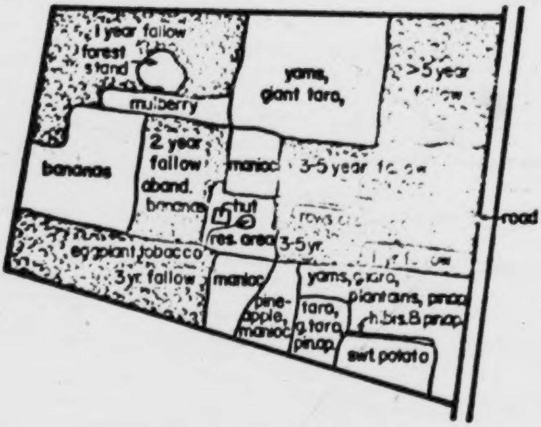

Az Mc
Rt
Gr
Mh
Aa
Am
Mc
Cm
Par
Bj
Gc
Cl
Hf
Cr
Pt
Pp
Ie
Pg
Co
Ca
Mn

Distribution of Important Tree Species
(Coconut Coverage: 100% Mature Palms; No Replanted Palms.)

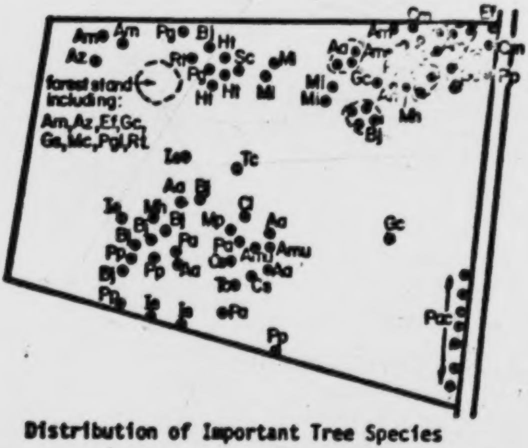
102
241
245
311
137
[351]

Figure 37. **SAMPLE BUSH ALLOTMENT NO. 71**

Location: Ha'asini **Area: 8.01 Acres**


1 year fallow
forest stand
mulberry
yams, giant taro,
>5 year fallow
bananas
2 year fallow aband. bananas
manioc
3-5 year fallow
hut
res. area
road
eggplant, tobacco
3-5 yr.
3 yr. fallow
manioc
pine-apple, manioc
yams, g.taro, plantains, pinap
taro, g.taro pinap
h.brs.& pinap
swt potato

Distribution of Major Crops


Am
Am
Pg
Bj
Ht
Az
Rt
Sc
Mi
Pg
Ht
Ht
Mi
Mi
Mi
Aa
Am
Gc
Cm
Ef
Cm
Pp
Mh
Bj
forest stand including:
Am, Az, Ef, Gc, Ge, Mc, Pgl, Rt.
Ie
Tc
Aa
Bj
Cl
Ie
Mh
Bj
Mp
Aa
Bj
Pa
Pa
Amu
Pp
Cs
Amu
Pp
Aa
Bj
Pp
Tc
Cs
Pp
Ie
Ie
Pa
Pp
Gc
Pac

Distribution of Important Tree Species

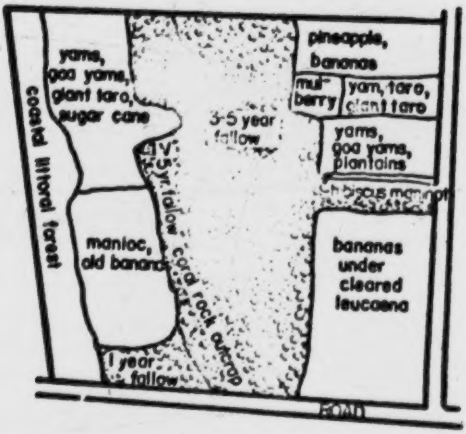
(Coconut Coverage: 10% Mature Palms; 5% Replanted Palms.)

88: Thaman K-5 (1967-1973) 1978 OU9 Tonga OU9
Tongatapu

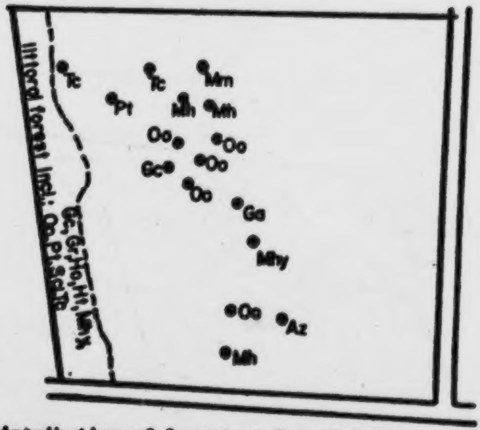
Figure 38. SAMPLE BUSH ALLOTMENT NO. 72

Location: Lavengatonga Area: 8.10 Acres

102
241
● 245
311
137


yams, goa yams, giant taro, sugar cane
coastal littoral forest
3-5 year fallow
5 yr. fallow coral rock outcrop
manioc, old bananas
1 year fallow
pineapple, bananas
mulberry
yam, taro, giant taro
yams, goa yams, plantains
hibiscus manihot
bananas under cleared leucaena
ROAD

Distribution of Major Crops


littoral forest incl.: Oo, Pi, Sc, Tc, Gc, Gr, Ho, Ht, Mhx
Tc
Tc
Mm
Pt
Mh
Mh
Oo
Oo
Gc
Oo
Oo
Ga
Mhy
Oo
Az
Mh

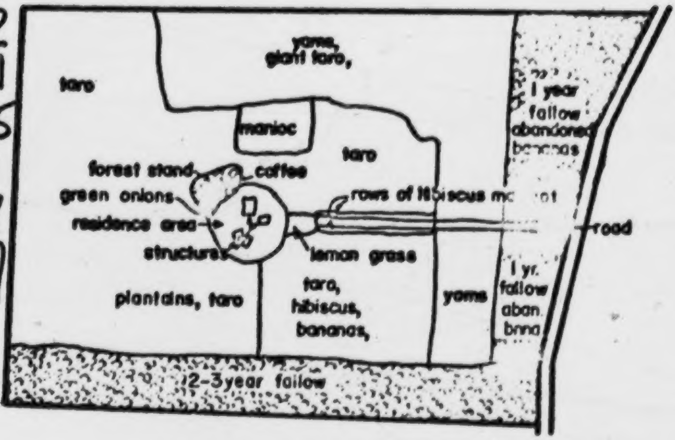
Distribution of Important Tree Species

(Coconut Coverage: 25% Mature Palms; 10% Replanted Palms.)

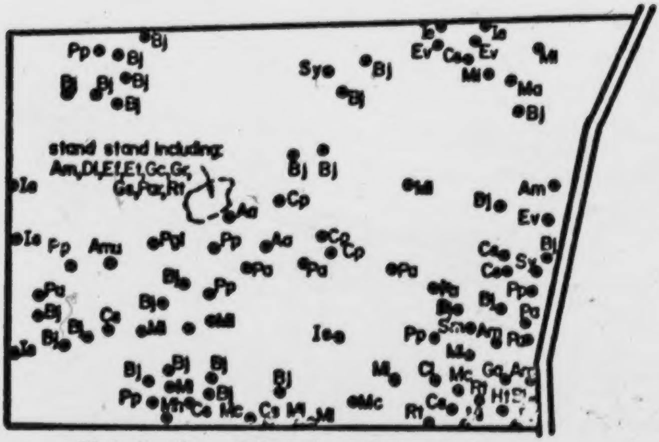
Figure 39. SAMPLE BUSH ALLOTMENT NO. 84

Location: Lapaha Area: 10.00 Acres

102
241
● 245
311
137
[351]


yams,
giant taro,
taro
1 year
fallow
abandoned
bananas
manioc
taro
forest stand
coffee
green onions
rows of hibiscus
residence area
road
structures
lemon grass
1 yr.
fallow
aban.
bnna
plantains, taro
taro,
hibiscus,
bananas,
yams
2-3year fallow

Distribution of Major Crops


Pp
Bj
Sy
Ie
Ev
Ca
Ev
Mi
Ma
stand stand including:
Am,Dl,Ef,Ei,Gc,Gc,
Gs,Pa,Rt
Cp
Aa
Am
Ev
Amu
Pgl
Pp
Cp
Pa
Sy
Cs
Mi
Pp
Sm
Am
Rt
Mc
Gc
Ht
Cl

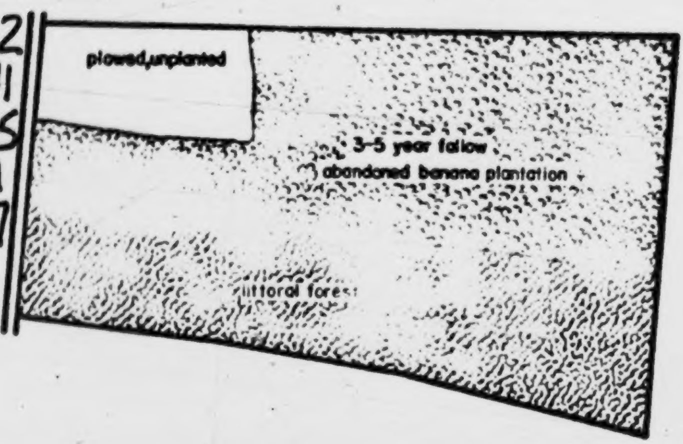
Distribution of Important Tree Species

(Coconut Coverage: 50% Mature Palms; No Replanted Palms.

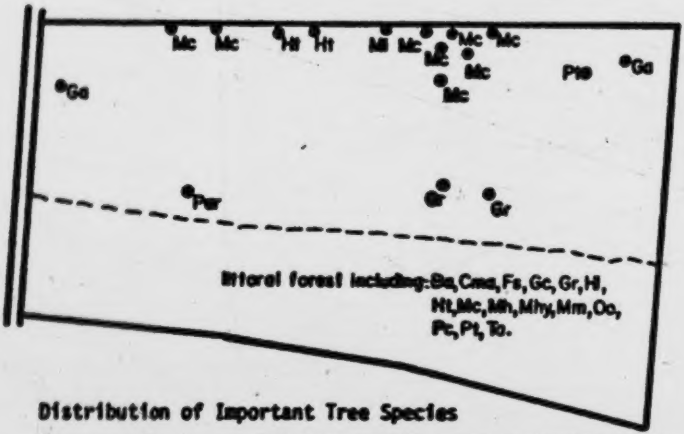
Figure 40. SAMPLE BUSH ALLOTMENT NO. 87

Location: Lapaha 'uta Area: 8.25 Acres

102
241
●245
311
137


plowed,unplanted
3-5 year fallow
abandoned banana plantation
littoral forest

Distribution of Major Crops


Mc
Mc
Ht
Ht
Mi
Mc
Mc
Mc
Mc
Mc
Mc
Ga
Pt
Ga
Per
Gr
Gr
littoral forest including: Ba, Cma, Fs, Gc, Gr, Hl, Ht, Mc, Mh, Mhy, Mm, Oo, Pc, Pt, To.

Distribution of Important Tree Species

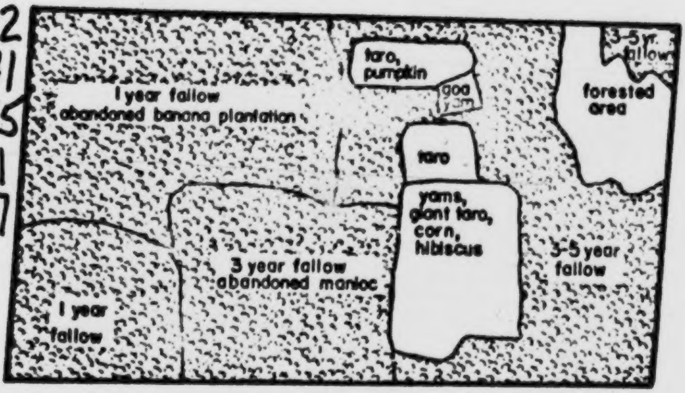
(Coconut Coverage: 50% Mature Palms; 50% Replanted Palms on Usable Portion of Allotment.)

88: Thaman K-5 (1967-1973) 1978 OU9 Tonga OU9
Tongatapu

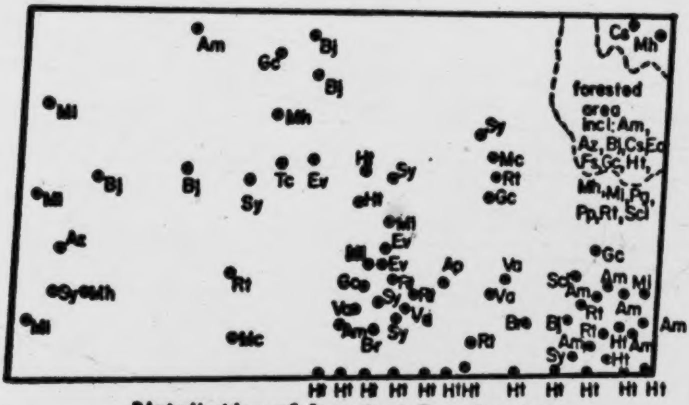
Figure 41. SAMPLE BUSH ALLOTMENT NO. 101

Location: Talafo'ou Area: 8.25 Acres

102
241
245
311
137


taro, pumpkin
goa yam
3-5 yr. fallow
1 year fallow
abandoned banana plantation
forested area
taro
yams, giant taro, corn, hibiscus
3 year fallow
abandoned manioc
3-5 year fallow
1 year fallow

Distribution of Major Crops

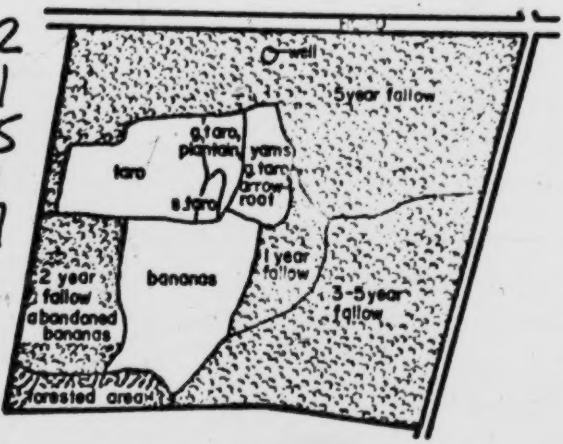

Am
Bj
Gc
Bj
Ml
Mh
Sy
forested area incl: Am, Az, Bj, Cs, Ec, Fs, Gc, Ht, Mh, Ml, Pg, Pp, Rt, Scl
Cs
Mh
Mc
Rt
Gc
Bj
Bj
Tc
Ev
Ht
Sy
Ml
Sy
Ht
Az
Ml
Ev
Ml
Ev
Ap
Va
Gc
Sy Mh
Rt
Gc
Rt
Va
Sc
Am
Am
Ml
Sy
Va
Rt
Ml
Va
Am
Br
Sy
Bj
Am
Mc
Br
Rt
Rt
Ht
Am
Sy
Ht
Ht Ht Ht Ht Ht Ht Ht Ht Ht Ht Ht Ht

Distribution of Important Tree Species
(Coconut Coverage: 10% Mature Palms; 50% Replanted Palms.)

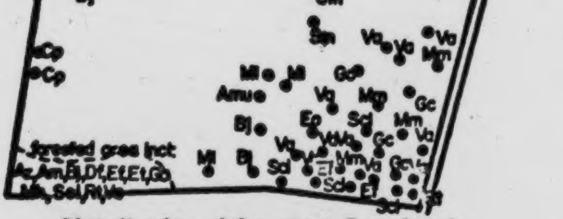
Figure 42. SAMPLE BUSH ALLOTMENT NO. 103

Location: Hoi Area: 8.26 Acres

102
241
●245
311
137


well
5year fallow
g.taro, plantain
yams g.taro arrow-root
taro
s.taro
bananas
1 year fallow
2 year fallow abandoned bananas
3-5year fallow
forested area

Distribution of Major Crops


Rf
Rt
Rt
Mc
Bj
Ml
Bj
Ml
Ml
Bj
Bj
Am
Gr
Gr
Gr
Ef
Ef
Gc
Ec
Bj
Ef
Bj
Ec
Ef
Bj
Sj
Bj
Pa
Pa
Bj
Cm
Sm
Va
Va
Va
Mm
Cp
Cp
Ml
Ml
Gc
Amu
Va
Mm
Gc
Bj
Ep
Scl
Mm
Va
Gc
Va
Va
Va
Mm
Va
Gc
forested area inct
Az,Am,Bj,Df,Ef,Et,Gc
Mm,Scl,Rt,Va
Ml
Bj
Scl
Ef
Scle
Ef
Scl

Distribution of Important Tree Species
(Coconut Coverage: 10% Mature Palms; No Replanted Palms.)

311 Grazing occurs mainly on hereditary estates or lease-
233 holdings, and out of the sample of 101 bush allotments only
one had any grazing land, approximately 3 acres (1.2
[245] hectares). Like some of the larger plantations, the
[137] allotment was partially fenced, was well planted with
coconut palms and scattered citrus, and other useful trees
with an understory dominated by *Paspalum conjugatum*
(*vailima*), *Elephantopus mollis*, *Psidium guajava* (*kuava*),
Stachytarpheta urticaefolia (*iku'ikuma*), and *Dryopteris*
000 *invisa* (*hulufe*). The practice of setting aside pasture
land will possibly become more common as a result of
initiation of the Cattle Subsidy Scheme in 1971.

241 With respect to cultivated land, it was often
difficult to differentiate between subsistence and commer-
241 cial crops. Bananas, watermelons, pineapples, garden
438 vegetables, and peanuts are grown primarily for export or
439 local sale but are occasionally cultivated for home use.
Conversely, many of the important subsistence crops, such
as yams, taro, plantains, and even manioc are often produced
128 for export and local sale. In order to simplify the
241 already complicated inventory scheme, it was decided to
tabulate as commercial crops all species such as bananas,
watermelons, and pineapples, that are commonly grown
commercially and to tabulate yams, taro, manioc, etc. as
241 subsistence crops. On this basis, of the total acreage
of 101 sample allotments, 30 percent was in subsistence

241
244
Table 31. Frequency and area as dominants of specified staple crops on 101 sampled bush allotments.

Crop	Frequency Occurrence	Total Acreage as Dominant Crop (Hectares)	% of Total Sample Acreage	% of Subsistence Acreage
Manioc	73	91 (37)	11	37
Yams	53	52 (21)	7	21
American taro	51	59 (24)	7	24
Sweet potato	15	8 (3)	1	3
Swamp taro	14	8 (3)	1	3
Goa yam	8	3 (1)	<1	1
American and swamp taro	7	4 (2)	<1	2
[245] Plantain	7	4 (2)	<1	2
Giant taro	1	1 (<1)	<1	1

241 244 245 In the case of mixed plots of American and swamp taro, it was not possible, in a number of cases, to decide which plant was dominant. In the case of plantains, Goa yams and, to some extent, taro, the frequency of occurrence and total acreage of these crops would be considerably higher, except for the fact that they are usually (especially in the case of plantains and giant taro) intercropped with yams and other crops and are only

241 244 245 occasionally planted alone as dominants. Nevertheless, Table 31 does give a good indication of the crops most widely cultivated as dominants during 1971.

241 None of these staple crops seem to be concentrated in specific areas of Tongatapu.

Supplementary Food Crops

Throughout the matrix of dominant staple crops and bush-fallow vegetation are found a variety of supplementary food plants which play an important role in the diet. [125] Because most of these are intercropped with the staple crops or found in bush fallow vegetation, the survey tabulated their frequency and abundance rather than the area occupied. 241 245 The papaya or lesi (Carica papaya) is the most widespread supplementary food plant, occurring on 88 of the sample bush allotments (Table 32). It is generally found either intercropped with other subsistence crops or as a volunteer in bush fallow. Three allotments had rows of papayas in small plantations, 40 allotments had at least 10 trees, and 45 had 1 to 9 trees.

241 In the cases of si (Cordyline terminalis), chili pepper or polo fifisi (Capsicum frutescens), and the cherry tomato or temata vao (Lycopersicon esculentum var. cerasiforme), it may be debated as to whether or not these are indeed "cultivated plants," because they are so commonly found as volunteers. All three species are widespread on

Table 32. Frequency of occurrence specified supplementary food crops found as non-dominants on 101 bush allotments.

241
244
245

Plant	Number of Allotments
Papaya	88
Cordyline	68
Chile pepper	60
*Bananas	59
*Plantains	48
Edible hibiscus	36
*Pineapple	31
Sugar cane	30
**Pata* banana	28
Cherry tomato	19
Pumpkin	17
Kava	14
Garden vegetables	14
Corn	10
Green onions	4
Coffee	3
Lemon grass	2
Amorphophallus	2
Granadilla	1

* Present as isolated or small groups of plants and discussed in detail under commercial crops.

241 bush allotments, usually amongst the secondary vegetation or as ruderals, and are occasionally planted or protected [245] in cultivated plots. A further difficulty arises in the case of Cordyline terminalis, which is planted as borders along roads or around houses, and has both edible and non-edible varieties. Unfortunately, during the study of the bush allotments, no distinction was made between these varieties.

245 Bananas, including pata, plantains, and pineapples are 241 important supplementary food crops as well as commercial crops. On a majority of the sample allotments they were intercropped with dominant staples, planted in small homogeneous patches or along borders of other crops or along paths. Of all the allotments where bananas were present (Table 32), only 15 had commercial plantings, none of which were pata bananas. In the case of plantains, only 7 allotments had homogeneous, obviously commercial stands. Similarly, out of the 31 allotments where pineapples were present, only 12 had homogeneous patches.

[262] Edible hibiscus or pele (Hibiscus manihot) and different varieties of taro constitute the main vegetable greens consumed by the average Tongan. This hibiscus was cultivated on 36 sample allotments (Table 32), of which 20 had more than 20 plants, 2 had 5 to 20 plants, and 3 had 1 to 5 plants. It was either intercropped with other subsistence crops, planted in small homogeneous patches, or along borders of cultivated areas or paths.

241
245

Table 33. Frequency of occurrence of specified garden vegetables on 101 bush allotments.

Crop	Frequency Occurrence
Tomatoes	9
Bell pepper	8
Green beans	5
Cabbage	4
Carrots	4
Lettuce	4
Cucumbers	3
Chinese cabbage	2
Radishes	1
Beets	1
Eggplant	1

capitata), carrots or kaloti (Daucus carota), lettuce or letisi (Lactuca sativa), cucumbers or kiukamipā (Cucumis sativa), Chinese cabbage or kapisi siaina (Brassica pekinensis), radishes or latisi (Raphanus sativa), beets or pitiluti (Beta vulgaris), and eggplant or painqani (Solanum melongena) were all found present on allotments in "non-commercial" quantities in at least one instance each. In most cases, they were planted together in small vegetable gardens. In some instances, they were cultivated close to dwellings on the bush allotment.

241
243 Corn or koane (Zea mays) was planted alone on about one-half acre (one-fifth hectare) of one allotment as a commercial crop. In the remaining 9 cases, it was intercropped with taro or giant taro, planted around the borders of yam patches, or in small mixed vegetable gardens.

241
244
[263] Green onions or onioni Tonga (Allium ascalonicum) are one of the most important herbs in Tongan cooking. On 3 of the 4 sample allotments where green onions were present, they were planted in well-ordered rows or homogeneous patches; in only one case were they planted amongst other subsistence crops.

241
245 Coffee or kofi (Coffea arabica) was found planted in the shade of small groves of trees on 2 allotments and under scattered trees on another.

241
249 Lemon grass or moengālō (Cymbopogon citratus), the leaves of which are used to brew tea, is generally found on town allotments, but was also cultivated in a small patch near a dwelling on 1 bush allotment and planted along a path through another allotment.

137
241
[261] Teve (Amorphophallus campanulatus), an aroid, formerly an important subsistence crop in certain areas of the Pacific (Massal and Barrau, 1956: 6), was found on only 2 of the sample allotments. In both cases, it was uncultivated and, according to informants, eaten only in times of famine.

241 245 **Granadilla or *pasiona* (*Passiflora quadrangularis*) was found on only 1 of the sample allotments along a trail through one-year bush fallow vegetation.**

241 **None of the supplementary crops seemed to be localized in particular regions of Tongatapu.**

Important Non-Food Crops

[125] **Throughout the matrix of major staple crops and secondary vegetation, there are also a considerable number of important non-food crops (Table 34). The survey of these, like that of supplementary food plants, emphasized frequency and abundance with a secondary concern for the areas occupied by the few species which are planted alone in homogeneous plots.**

241 247 [285] **The most widespread non-food plant which is cultivated or at least protected on bush allotments is pandanus (*Pandanus spp.*). The leaves or *lou'akau* are used as fiber for weaving baskets, fine mats, and other plaited material. These species are more bush-like than the common screwpine or *fā* (*Pandanus tectorius*) and are found as borders, alone in homogeneous plots, amongst secondary vegetation as relics and volunteers, and in coastal and swamp forests on many allotments. Of the 76 sample allotments where pandanus was present, 32 had more than 25 plants, 21 had 10 to 25 plants, and 23 had less than 10. Of the 32 allotments with more than 25 plants, 4 had solid plantings of Pandanus averaging about .02 acres (.01 hectares).**

241 ment as a small stand near a temporary dwelling and on
249 another as a carefully cultivated plot approximately one-eighth acre (0.05 hectare) in area.

Turmeric or ango (Curcuma longa) was found on two allotments in a wild state. It is generally protected owing to the value of its rhizome for the preparation of a yellow dye (enga) and various medicines.

Uhi (Evodia hortensis f. simplicifolia) was on 2 sample allotments as isolated bushes, which were either cultivated or protected for medicinal use.

241 There are, no doubt, additional valuable non-food plants on Tongatapu bush allotments not included in the 101 sample allotments.

Commercial Crops

241 Such crops as bananas and plantains, watermelons,
128 peanuts, rock melons, vanilla, and most garden vegetables are classified here as commercial crops, as they are all commonly cultivated for either export or local sale. Nevertheless, it should be stressed that they are also cultivated on a subsistence basis. Where these crops were present in commercial quantities, 1/10 acre or more, acreage estimates were made; otherwise presence was merely noted (Table 35).

245 As these data show, commercial bananas or Siaine
241 Ha'amoa (Musa sapientum) are the most widespread commercial crop. In almost all cases, bananas were planted alone in

241
245
244

Table 35. Frequency of occurrence and acreage of specified crops when present in commercial quantities on 101 sample allotments.

Crop	Number of Allotments	Total Acreage (Hectares)	% of Sample Acreage	% of Commercial Acreage
Bananas	15	15.2 (6.2)	1.8	42
Watermelons	4	6.1 (2.5)	0.8	17
Plantains	5	4.6 (1.8)	0.6	13
Pineapples	7	3.8 (1.5)	0.5	11
Garden vegetables	6	2.3 (0.9)	0.3	6
Peanuts	4	1.5 (0.6)	0.2	4
Rock melons	2	1.5 (0.6)	0.2	4
Corn	1	0.5 (0.2)	0.1	2
Vanilla	1	0.3 (0.1	<0.1	1

245
241 orderly rows according to Tonga Produce Board recommendations. In four cases, however, the plantations were poorly maintained and ceased to be productive on a commercial basis. In addition to these plantations in a poor state of maintenance, 67 percent of the sample allotments had [137] abandoned banana plantations. Most of these plantations were probably abandoned due to black-leaf-streak fungus (*Mycosphaerella fijiensis*) and bunchy-top virus; the former has been particularly severe since 1968.

241 Plantains or hopa (Musa paradisiaca) like bananas, are
245 susceptible to black-leaf-streak and bunchy top diseases, but there were no abandoned plantain plantations on the sample allotments.

241 Watermelons or meleni (Citrullus vulgaris) are general-
244 ly grown alone on large tracts of plowed land. Occasionally, they are also intercropped with yams, corn, or manioc.

241 The pineapple or faina (Ananas comosus) is generally
245 planted alone, although in one instance it was planted under manioc.

241 Garden vegetables, were present on only 6 allotments
244 where they were planted on contiguous plots (>1/10 acre) indicating possible commercial cropping. Only three crops were obviously grown commercially; these were tomatoes or temata (Lycopersicon esculentum), bell pepper or polo (Capsicum annuum),and green beans or piini (Phaseolus vulgaris). They were generally found planted alone. There was one mixed planting of bell peppers, green beans, and bananas.

Peanuts or pinati (Arachis hypogaea) accounted for 4 percent of the commercial acreage and were planted alone on plowed plots. On two allotments , peanuts had been recently harvested.

The cantaloupe, rock melon or meleni maka (Cucumis melo var. cantalupensis), which the King of Tonga, Taufa'ahau Tupou IV, has championed as having considerable

241 244 **promise as an export crop, was found on 2 percent of the sample allotments, comprising 4 percent of the commercial acreage. In one instance, it was planted alone and, in another, was planted together with manioc.**

241 243 [235] **Corn or *koane* (*Zea mays*) was found in one instance in a large homogeneous stand of approximately 0.5 acres (0.2 hectares). Commercial corn growing on Tongatapu seems to be increasing owing to the establishment of a chicken feed industry, which has offered to buy increasing amounts of dried corn from farmers.**

241 245 **Vanilla or *vanila* (*Vanilla planifolia*) was prerent on only one of the sample allotments. There were approximately 40 individual plants, each supported by a physic nut tree or *fiki* (*Jatropha curcas*). These vanilla plants, like many others that have been recently planted on Tongatapu, were not yet in production.**

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Nature of Intercropping

One of the major foci of the survey of bush allotments was the nature of intercropping practices. The primary focus was on major staple and commercial crops. Supplementary crops are infrequently intercropped with major crops and are more often planted as borders on or around dwellings on bush allotments.

241 244 **Yams ('*ufi*) are generally the first crop planted in a recently cleared area and it is in the yam garden or *ma'ala* where intercropping is most prevalent. In the 53 instances**

241 245 ities on seven allotments, were intercropped in only one case; this was with manioc.

241 245 The only other cases of commercial intercropping were one case where capsicum and green beans were planted together and another where cantaloupes (meleni maka) were planted with manioc.

241 178 Although intercropping, as part of commercial cropping, is discouraged, this practice continues on bush allotments because emphasis on subsistence production is still great and commercial crops are generally of secondary importance.

Important Tree Species

241 245 A considerable number of important tree species are either cultivated or protected on bush allotments throughout Tongatapu.

Coconut Palms

241 245 125 128 In the case of coconut palms, estimated cover was used rather than counts of individual trees. The intervals used for estimating cover were: 100%, 75%, 50%, 25%, 10%, 5% and 0% (see Appendix A).[A] Cover was defined as being 100% where palms were planted densely enough to total about 60 per acre (150 per hectare). The head of the Coconut Replanting Scheme considered this to be a fair estimate of the number of palms which, if planted throughout an allotment, would provide optimum yields (Liyanage, D.V., 1971, personal communication). Although individual

[A] [See Category 125, pp. 350-358--Analyst.]

241 **palms were not counted as part of the survey, after the**
245 **completion of the survey, the palms on 16 of the sample**
128 **allotments were counted to determine the accuracy of the**
125 **estimates (Table 36).**

241 **Table 36. Inventories of coconut palms on 16 selected bush allotments and the corresponding survey estimates.**
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Allotment No.	Acreage	(Hectares)	Estimated Coverage	Estimated Number	Actual Count
1	7.58	(3.07)	25%	115	141
2	8.25	(3.34)	75%	375	336
3	8.26	(3.34)	75%	375	354
6	6.41	(2.59)	50%	194	286
7	8.00	(3.24)	25%	121	172
8	4.22	(1.71)	25%	64	116
9	8.47	(3.43)	25%	128	234
10	8.36	(3.38)	50%	253	245
12	4.76	(1.93)	75%	216	211
23	8.25	(3.34)	25%	125	135
27	5.01	(2.03)	100%	303	427
33	4.10	(1.66)	50%	124	169
34	6.22	(2.52)	75%	376	296
59	8.27	(3.35)	75%	376	452
75	8.25	(3.34)	25%	125	155
77	8.25	(3.34)	10%	100	70

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Results of the survey(Table 37) indicate that the coconut palm is the dominant feature on most bush allotments. A majority have at least 200 palms and some 500 or more. The median coverage was 50 percent(Table 37) or approximately 250 palms on an 8 1/4 acre allotment.

Table 37. Number of sample allotments (out of 101) having specified covers of mature and replanted coconuts.

	100%	75%	50%	25%	10%	5%	0%	Total
Mature palms	8	22	21	30	13	4	3	101
Replanted palms	3	7	12	13	9	12	45	101

On 51 of the 101 sample allotments, coconut palms were planted in rows similar to a commercial plantation, with an average distance of about 30 feet between rows and 20 to 30 feet between trees in a given row. On the other allotments, the palms were planted more haphazardly. In both cases, however, the palms were usually unevenly distributed throughout the allotment, with portions being left open for yams and other sun-loving plants.

Only in the case of allotments with less than 10 percent mature coconut coverage did there seem to be any geographical localization. These areas of low-density coconut coverage, which are possibly a result of frequent wildfires, were concentrated south of Vaini and in north-central Hahake south-west of Kolonga(Figure 8).[A]

[A] [See Category 116, pp. 38-A--38-B--Analyst.]

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[654] Only 56 of the 101 sample allotments had recently planted coconuts. The median coverage for these allotments was only 25 percent. Because of senility and declining productivity of most palms on Tongatapu, the Coconut Replanting Scheme has subsidized the planting of new palms. Although a majority of allotments had some replanted palms, in very few instances were they well maintained. Nevertheless, there seemed to be sufficient replanting to insure the coconut palm's future as the dominant tree and most valuable plant on the bush allotments.

Fruit Trees

[125] In addition to coconut palms, there were 25 species of fruit trees among the plant associations on the 101 sample bush allotments (Table 38). For most species, numbers of individuals were tabulated, but individual Citrus species were difficult to differentiate and only presence or absence was noted.

[313] The most common trees were mango (Mangifera indica), citrus trees (Citrus spp.), tava (Pometia pinnata), breadfruit or mei (Artocarpus altilis) and Tahitian chestnut or ifi (Inocarpus edulis), all of which were present on over 50 percent of the sample bush allotments. In most cases, these trees are protected and preserved during the clearing of secondary vegetation for cultivation. However, there is a growing tendency to utilize many of these important tree crops for firewood and timber.

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Table 38. Frequency of occurrence of specified fruit trees on 101 bush allotments (individual *Citrus* trees were classified only as present or absent).

Scientific Name	Tongan Name	Present	5-9 Trees	10+ Trees
Mangifera indica	*mango*	79	27	9
Citrus spp.	*moli*	72	9	12
C. sinensis	*moli kai*	(49)	-	-
C. reticulata	*moli peli*	(43)	-	-
C. limon	*lemani*	(18)	-	-
C. sp.	*moli vaikeli*	(9)	-	-
C. maxima	*moli Tonga*	(7)	-	-
C. medica	*kola*	2	-	-
C. aurantifolia	*laimi*	(1)	-	-
C. aurantium	*moli mahi*	(1)	-	-
Pometia pinnata	*tava*	70	27	7
Artocarpus altilis	*mei*	66	19	13
Inocarpus edulis	*ifi*	55	8	1
Psidium guajava	*kuava*	53	8	26
Persea americana	*avoka*	38	3	0
Terminalia catappa	*telie*	17	1	2
Annona muricata	'*apele* '*Initia*	16	0	0
Spondias dulcis	*vi*	13	0	0
Syzygium malaccense	*fekika*	11	0	0
Syzygium jambos	*fekika palangi*	2	0	0

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Table 38. Continued.

Scientific Name	Tongan Name	Present	5–9 Trees	10+ Trees
Theobroma cacao	*koko*	1	0	0
Anacardium occidentale	*apu*	1	0	0
Ficus carica	*fiki Palangi*	1	0	0
Malus pumila	'*apele Palangi*	1	0	0
Prunus persica	*piisi*	1	0	0

Mango, citrus trees, and breadfruit are found randomly scattered throughout bush allotments, as well as cultivated or preserved in small groves, often near dwellings. *Tava* and the Tahitian chestnut or *ifi* are found more often in a wild state, generally randomly scattered throughout, the allotment. Occasionally, these trees are planted or preserved as allotment boundary markers and in the past, before formal cadastral surveys, wild Tahitian chestnut trees, in particular, were common boundary markers.

The guava is also widespread on bush allotments but is considered to be more of a noxious weed than a valuable tree species and, although large trees are occasionally protected, especially around dwellings, guava is generally cleared together with the secondary vegetation before [128] cropping. The figures in Table 38 include only large guava

241 trees and not seedlings among the secondary vegetation.
245 Almost all guava trees that were inventoried were found in
[128] older secondary vegetation.

Other common trees found on over 10 percent of the allotments were avocado or *avoka* (*Persea americana*), Indian almond or *telie* (*Terminalia catappa*), soursop or '*apele 'Initia* (*Annona muricata*), Polynesian vi-apple or *vi* *Spondias dulcis*), and Malay apple (*Syzygium malaccense*).

A number of more recently introduced fruit trees were observed on only one or two sample bush allotments: the rose apple or *fekika Palangi* (*Syzygium jambos*), cocoa or *koko* (*Theobroma cacao*), the cashew or *apu* (*Anacardium occidentale*), the edible fig or *fiki Palangi* (*Ficus carica*), the apple or '*apele Palangi* (*Malus pumila*), and the peach or *piisi* (*Prunus persica*). It is interesting to note that three of these six species are described by the suffix *Palangi* meaning European.

Fruit trees constitute a dominant feature on most bush allotments and are almost always, except in the case of the guava, planted or protected. The most important species continue to be the traditional species of Southeast Asian or Pacific origin, including mango, citrus, *tava*, breadfruit, Tahitian chestnut, Indian almond, soursop, vi-apple, and the Malay apple, together with a number of introductions from America, such as avocado and guava.

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245 The more recently introduced exotics are less frequently cultivated on bush allotments and are generally found near dwellings.

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Other Useful Trees

In addition to coconut palms and fruit trees, there are a great variety of other useful trees found on bush allotments (Table 39), the uses of which are described in Appendix E.^A^ Only six species were found on over 50 percent of the sample allotments: koka (Bischofia javanica), tuitui (Aleurites moluccana), fau (Hibiscus tiliaceus), nonu (Morinda citrifolia), loupata (Macaranga harveyana), and tavahi (Rhus taitensis). All six seem to be native species, common to the Southeast Asia-Pacific region, and are generally found in secondary forests or primary littoral and swamp forests throughout Tongatapu. On bush allotments, they occasionally form contiguous stands but are more often scattered throughout the matrix of cultivated areas and secondary vegetation. Except in the cases of Hibiscus tiliaceus, Morinda citrifolia, and Macaranga harveyana, which are often removed, these trees are generally protected when secondary vegetation is cleared for cultivation. Hibiscus tiliaceus and Aleurites moluccana commonly serve as boundary markers on bush allotments.

Several other species were present on at least ten percent of the 101 bush allotments (Table 39). Of these, fā (Pandanus tectorius), fo'ui (Grewia crenata), kulukulu

^A^[See Category 116, pp. 377-431--Analyst.]

241 137 stands of secondary forest (possibly primary forest in some cases). *Ahivao* (*Vavaea amicorum*) and *takafalu* (*Micromelum minutum*) are found both in secondary forest and in stands of *Leucaena leucocephala*. Those generally found as isolated individuals scattered throughout bush allotments are *ngatae* (*Erythrina variegata*), *mohokoi* (*Cananga odorata*), *puko* (*Gyrocarpus americanus*), *lopa* (*Adenanthera pavonina*), *heilala* (*Garcinia sessilis*), and *ahi* (*Santalum yasi*); these are all usually preserved when an area is cleared for cultivation. On one allotment, however, approximately 24 individual *S. yasi* trees were found. Some of the previously mentioned species such as *Grewia crenata*, *Pandanus tectorius*, *Aliphitonia zizyphoides*, *Pittosporum arborescens*, *Myrtya macrophylla*, and *Ficus spp*. are also occasionally found growing individually, although more [245] subject to removal. *Erythrina variegata*, *Ceiba pentandra* (*vavae*), and *Cananga odorata* are frequently deliberately planted, the former two along borders of, or as boundary markers, for bush allotments.

The remaining infrequent tree species, were found to be present on less than ten percent of the bush allotments (Table 39). Those infrequent tree species characteristically found in the coastal littoral forest association include *toto* (*Cerbera manghas*), *fao* (*Ochrosia oppositifolia*), *fotulona* (*Hernandia ovigera*), *futu* (*Barringtonia asiatica*), *feta'u* (*Calophyllum inophyllum*), *kotone* (*Myristica

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The species which are more commonly found as dispersed individuals include *hehea* (*Syzygium corynocarpium*), *mo'ota* (*Dysoxylon forsteri*), *manaui* (*Garuga floribunda*), *pipi* or *pipi failolo* (*Parinarium glaberrimum*), *pua Tonga* (*Fagraea berteriana*), *koli* (*Syzygium neurocalyx*), and *volovalo* (*Premna taitensis*). Although these plants are also found as members of forest stands, they are more commonly present as individual trees that have been protected, especially near dwellings and along property lines. In no instances were there more than ten individuals of any of these species on a given allotment.

The native trees that are found infrequently on bush allotments, but do not seem to be protected, are *mangele* (*Trema orientalis*), *te'epilo 'a Maui* (*Geniostoma rupestre*), *'ovava* (*Ficus obliqua*), *manonu* (*Terenna sambucina*), and *malamala'afonua* (*Homolanthus nutans*). *Trema orientalis* and *H. nutans* seem to be pioneer species generally found in thickets; *G. rupestre* is generally found in seaside thickets on allotments near the lagoon or the southern windward coast. *Ficus obliqua*, which starts as a parasite, often on *Bischofia javanica*, is found occasionally on allotments throughout Tongatapu. *Terenna sambucina* is found in secondary forests throughout Tongatapu.

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The trees that were found in limited numbers in what seemed to be a purposely planted state were *fiki* (*Jatropha curcas*), *kalosipani* (*Plumeria acuminata*), *sipaisi*

241 (Syzygium aromaticum), huni (Phaleria disperma), fehi 245 (Bauhinia monandra), and sita (Melia azedarach). Jatropha curcas is commonly planted as a living fence and, on one sample allotment, to support vanilla. The other species are generally planted as borders near dwellings or around 137 small family cemeteries. Phaleria disperma is also found wild in coastal littoral forest, while M. azedarach is sometimes found as an escape.

241 245 654 318 Three tree species that have been introduced by the Department of Agriculture as part of a reforestation program were also found on some of the sample allotments: silky oak or 'oke (Grevillea robusta) on eight allotments; Australian gum or pulukamu (Eucalyptus spp.) on two allotments; and cigar box cedar or sita Palangi (Cedrela odorata) 241 245 on one allotment. Extensive stands of G. robusta and C. odorata approximately seven years in age had been planted on one allotment.

241 137 On the sample bush allotments there seems to be a lower concentration of useful trees in west central Hahake, between Vaini and Fua'amotu and in north central Hahake, southwest of Kolonga, presumably because of the high incidence of plowing and frequent wildfire.

241 137 313 Although there is still a considerable diversity of valuable trees found throughout the cultivable area as well as in portions of coastal, swamp, and mangrove forests on Tongatapu bush allotments, the current shortage of timber

241 and firewood, together with the increasing use of the plow,
137 will undoubtedly bring about a further reduction of these
313 species. Trees such as nukonuka (Decaspermum fruticosum),
137 tangato (Pleiogynium solanderi), and hea (Parinarium insularum) which, according to Tongan informants, were common throughout Tongatapu in the past, were not encount-
137 ered in the sample of the 101 bush allotments. The great-
245 est reduction of the number of valuable tree species was probably due to the rapid expansion of the banana industry
137 in the mid-1960's. The demand for banana cases led to the
313 uncontrolled milling of the timber resources of Tongatapu,
318 where most of the Kingdom's cases were produced until 1967. As early as 1964, the Annual Report of the Minister of Agriculture stated that:

> The situation in Tongatapu with regard to the felling of trees for the saw-mills is critical as the usual source of supplies [natural forests] have almost depleted [sic] and loggers have already started their attacks on useful trees such as mangoes, candlenut, etc. To make things worse the old feta'anu [Excoecaria] trees on the shore have also been used by millers which consequently will weaken the protection of the coasts and the shores against sea erosion (Government of Tonga, 1965: 21).

In 1968, the Agriculture Department reported that:

> ...the supply of logs on Tongatapu has already reached the critical level following the extermination of natural forests and in some cases useful tree crops also. As a result, most of the sawmillers operating around Tongatapu have moved to 'Eua Island where there is a more abundant supply of logs (Government of Tonga, 1969a: 13).

241 bush.

Of all commercial crops, coconut palms seem to receive
241 the least care and on 42 of the 101 sample allotments
245 there was evidence of wasted nuts rotting on the ground.
There was also considerable evidence of rat damage to
coconut palms; 8 allotments had numerous fallen nuts which
had been gnawed by rats and another 23 allotments had some
evidence of rat damage.

241 There were 7 cases where at least one-quarter acre of
242 hyacinth bean (Dolichos lablab) had been planted as a green
manure crop and another 13 cases where it was present in
smaller concentrations. This is one of the green manure
crops introduced by the Department of Agriculture.

241 As for preparation of land prior to cropping, there
were 82 cases where burning was evident and 43 cases where
[654] plowing was evident. The government encourages plowing
and discourages burning because it injures coconut palms
and often causes wildfires, especially in Vahe Loto, the
Central District.

241 Improvements which were found on the 101 allotments
361 included 13 permanent residences and 13 temporary thatched
huts. Where permanent homes were present, allotments were
usually better maintained and had more cultivated trees and
plants, such as garden vegetables, which require constant
care. The temporary dwellings are generally used while
guarding crops from theft or when a farmer or his family
stay overnight at the bush allotment.

241 stay overnight at the bush allotment.

241 Wells were found on 6 allotments and a cement rain -
312 catchment tank was present on another. On 4 of these, there
were permanent dwellings and on 3, garden vegetables were
grown.

241 There were 11 allotments with copra driers; 7 of these
245 had permanent dwellings and two had substantial temporary
dwellings.

241 Good condition barbed-wire fencing was found around
417 parts of 10 allotments, poor condition fencing around 2,
and another 24 had some fencing along one side or across
241 the central portion of the allotment. In almost all cases,
fences were used to protect crops from livestock, particu-
241 larly horses. Although treated wood fenceposts are becoming
417 increasingly common, living fence posts such as ngatae
245 (*Erythrina variegata*) and fiki (*Jatropha curcas*) are more
common.

241 As for accessibility, 89 allotments had some kind of
491 roads bordering or through the property; of these, only 29
had paved coral or black-top roads. In about half of the
cases where allotments had unpaved roads, these were often
impassable, except by horsecarts. There is a continuing
effort to improve accessibility by expanding the paved
feeder-road system.

241 There were 10 allotments with pigs; in 7 cases, they
231 were either tethered or roaming free. On all but one of

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Selected Agricultural Practices and Conditions

All allotments had at least one main sleeping house or *fale mohe* (Table 43).

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Table 43. Frequency occurrence of specified housetypes on 192 town allotments (113 in Nuku'alofa and 79 in rural villages) (The numbers in parentheses indicate the number of allotments with more than one of a given housetype).

Housetype	Nuku'alofa Number of Occurrences	Rural Number of Occurrences
Large Wooden	64 (3)	27
Large Brick	11	8
Small Wooden	19 (1)	5
Thatch	56 (3)	42
TOTAL	150 (7)	82

[343]

The rural areas have a lower percentage of large wooden houses than the Nuku'alofa area. The frequency of occurrence of other structures such as separate kitchens (*peito*), outhouses (*fale vao*) and wash houses (*fale kaukau*) reflected no significant differences between the rural and urban areas.

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[417]

A large number of allotments, particularly in Nuku'alofa, were fenced with either barbed wire or living fences (Table 44). *Cordyline terminalis* (*si*) generally

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245 serves as a border rather than a true hedge or fence. The hedges and fences are useful for ornamental purposes, to delineate property lines, and to protect gardens from livestock damage.

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369 Table 44. Frequency occurrence of specific fence types on 192 town allotments (113 in Nuku'alofa and 79 in rural villages).

Fencetype	Nuku'alofa Occurrences	Rural Occurrences
Hibiscus spp.	45	18
Nothopanax spp.	45	11
Barbed Wire	34	19
Cordyline terminalis	26	4
Acalypha spp.	14	1
Erythrina variegata	9	0
Thunbergia erecta	8	4
Jatropha curcas	7	0
Wood	0	1

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369 One major difference between the Nuku'alofa and rural town allotments is the greater availability of water in Nuku'alofa (Table 45). In the rural villages, although some wells and rainfall catchment systems exist, there were no private water systems and most people depended

241 on 10 percent or less of all the sample town allotments.
244 On the other hand, staple crops such a swamp taro
241 (*Colocasia esculenta*), American taro (*Xanthosoma spp.*),
244 giant taro (*Alocasia macrorrhiza*), plantains (*Musa paradisiaca*),
245 *pata* bananas (*Musa sp.*), and bananas (*Musa sapientum*),
which require more care and are often planted individually,

241 244 245 369 Table 47. Frequency and percent occurrence of specified staple crops on 192 town allotments (113 in Nuku'alofa and 79 in the rural villages).

Crop	Nuku'alofa Number of Occurrences	%	Rural Allotments Number of Occurrences	%	Total Number of Occurrences	%
Swamp taro	62	55%	4	5%	66	34%
Plantains	43	38%	6	8%	49	26%
American taro	44	39%	2	3%	46	24%
Pata bananas	44	39%	2	3%	46	24%
Bananas	43	38%	2	3%	45	23%
Giant taro	35	31%	7	9%	42	22%
Manioc	18	16%	1	1%	19	10%
Yams	16	14%	3	4%	19	10%
Sweet potato	7	6%	0	0%	7	4%
Goa yam	6	5%	0	0%	6	3%

241 were more common (plantains and bananas are included as
244 staple crops here because they are not cultivated commer-
[245] cially on town allotments). In Nuku'alofa, these crops
were grown on more than one-third of all sample allotments.
Swamp taro was most common, possibly because of the swampy
nature of the low-lying area of Nuku'alofa and the ease
with which it can be planted.

241 The cultivation of all staple crops seems to be much
369 more widespread on Nuku'alofa town allotments than on the
rural town allotments. There seem to be three major
[423] factors influencing this distribution. First, a higher
proportion of people in the Nuku'alofa area have neither
tenure or access to bush allotments (Table 48) and conse-
quently depend upon the market and their town allotments
as primary sources of agricultural products. Secondly,
rural houses are generally closer to their respective bush
allotments, which facilitates their use for crops which are
[685] especially susceptible to theft. Theft seems to be
increasingly bothersome and, consequently, crops which can
be grown safely on the nearby bush allotments of rural
residents are often grown to a greater extent by Nuku'alofa
241 residents on their town allotments. Finally, probably
369 the major deterrent to more extensive cropping on rural
231 town allotments is the presence of free roaming pigs and
other animals. In Nuku'alofa, it is illegal for pigs and
other animals to roam free.

241 **Table 50. Continued.**
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Scientific Name	Nuku'alofa	Rural	Total
Nicotiana fragrans	1	0	1

241 a number of varieties of *Pandanus* (*tofua*, *tapahina*, *paongo*
824 and *kie*), as well as *Gossypium brasiliense*, *Coix lachryma-jobi*, *Broussontia papyrifera*, and *Maranta arundinacea*.
241 Also of considerable importance were plants used for tradi-
824 tional house and body ornamentation: *Gardenia spp.*,
278 *Coleus amboinicus*, *Hedychium spp.* (*tevunga* and *teuila*),
and *Artabotrys uncinatus*; and for medicinal purposes:
Achyranthes aspera, *Zingiber zerumbet*, *Vigna marina*,
Curcuma longa, *Jasminum spp.*, *Piper puberulum*, and *Wedelia*
[226] *biflora*. The others are all used in some way (Appendix E)[A],
such as Derris elliptica, which is used for stupefying
241 fish. Although there is a considerably higher frequency
369 of non-food plants than food plants on rural town allot-
ments, there is still a higher frequency of these plants on
Nuku'alofa town allotments.

Important Tree Species

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Fruit Trees

245 Fruit trees were the dominant vegetation type on most
369 town allotments, both in Nuku'alofa and in the rural

[A] [See Category 116, pp. 377-431--Analyst.]

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369 villages(Table 51). The similarity in frequencies of fruit trees on the Nuku'alofa and rural allotment may be partly explained by the resistance of trees to livestock damage and the need to safeguard the fruit from occasional theft.

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245 The most widespread species are primarily native species or pre-European introductions: the breadfruit (*Artocarpus altilis*), which was present on over three-quarters of all sample allotments, mango (*Mangifera indica*), the coconut (*Cocos nucifera*), *tava* (*Pometia pinnata*), citrus trees (*Citrus* spp.), Tahitian chestnut (*Inocarpus edulis*), Indian almond (*Terminalia catappa*), and Polynesian vi- apple (*Spondias dulcis*). Other post - European introductions from America included soursop (*Annona muricata*), *avocado* (*Persea americana*), *papaya* (*Carica papaya*), sweetsop (*Annona squamosa*), and guava (*Psidium guajava*) (On town allotments the guava generally is found as a cultivated tree rather than a secondary vegetation species.) The remainder of the fruit trees are mostly of more recent introduction, such as the tamarind (*Tamarindus indica*) and members of the genus *Musa* which where not considered under staple food crops.

Other Useful Trees.

[369] There is an even greater range of other useful native and introduced tree species (Table 52). As in the case of fruit trees, there was no significant difference in the frequency of occurrence between Nuku'alofa and rural sample

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Table 51. Frequency occurrence of specified fruit trees on 192 town allotments (113 in Nuku'alofa and 79 in rural villages).

Scientific Name	Nuku'alofa	Rural	Total
Artocarpus altilis	91	57	148
Mangifera indica	76	39	115
Cocos nucifera	66	47	113
Pometia pinnata	61	17	78
Citrus limon	46	29	75
Annona muricata	50	21	71
Citrus reticulata	44	22	66
Persea americana	48	16	64
Carica papaya	58	8	66
Psidium guajava	42	14	56
Citrus sinensis	17	22	39
Citrus medica	23	4	27
Annona squamosa	13	8	21
Inocarpus edulis	14	4	18
Musa sp.	9	6	15
Spondias dulcis	7	4	11
Terminalia catappa	7	2	9
Citrus aurantifolia	7	1	8
Tamarindus indica	4	2	6
Syzygium malaccense	2	3	5

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Table 51. Continued.

Scientific Name	Nuku'alofa	Rural	Total
Citrus sp.	3	1	4
Musa lady-finger clone	3	0	3
Syzygium jambos	2	0	2
Annona reticulata	2	0	2
Ficus carica	2	0	2
Morus alba	1	0	1
Malus pumila	1	0	1

town allotments. Most of these trees seem to have been purposefully planted, although some species such as Hibiscus tiliaceus, Aleurites moluccana, Pandanus tectorius, Casuarina equisetifolia, and Bischofia javanica might have been protected relicts of former natural vegetation. There were many instances of deliberate planting of useful native trees which are becoming increasingly difficult to find growing wild, such as Decaspermum fruticosum, Santalum yasi, and Syzygium neurocalyx. (The major uses of these trees are listed in Appendix E.)A

241 In summary, the survey of the Nuku'alofa and rural village town allotments indicates that the town allotments

A[See Category 116, pp. 377-431--Analyst.]

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Table 52. Frequency occurrence of specified useful trees in 192 town allotments (113 in Nuku'alofa and 79 in rural villages).

Scientific Name	Nuku'alofa	Rural	Total
Plumeria spp.	70	44	114
Hibiscus tiliaceus	39	29	68
Aleurites moluccana	34	9	43
Ceiba pentandra	11	29	40
Pandanus tectorius	13	13	26
Glochidion spp.	25	1	26
Casuarina equisetifolia	18	6	24
Bischofia javanica	9	14	23
Cananga odorata	15	7	22
Erythrina variegata	11	11	22
Syzygium aromaticum	17	5	22
Cinnomonum zeylanicum	16	5	21
Phaleria disperma	13	7	20
Aglaia saltatorum	12	5	17
Syzygium corynocarpium	15	1	16
Morinda citrifolia	7	9	16
Alyxia stellata	13	2	15
Fagraea berteriana	12	3	15
Macaranga harveyana	12	1	13
Ficus obliqua	11	1	12

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Table 52. Continued.

Scientific Name	Nuku'alofa	Rural	Total
Jatropha curcas	6	5	11
Tournefortia argentea	4	4	8
Garcinia sessilis	4	3	7
Premna taitensis	4	3	7
Calophyllum inophyllum	7	0	7
Hernandia moerenhoutiana	4	2	6
Excoecaria agallocha	1	5	6
Ochrosia oppositifolia	5	0	5
Adenanthera pavonina	5	0	5
Santalum yasi	3	2	5
Rhizophora spp.	2	2	4
Vitex trifolia	1	3	4
Grevillea robusta	3	0	3
Ellatostachys falcata	3	0	3
Ficus sp.	0	3	3
Gyrocarpus americanus	2	0	2
Decaspermum fruticosum	2	0	2
Diospyros laterifolia	2	0	2
Syzygium neurocalyx	2	0	2
Hernandia ovigera	1	1	2
Garuga floribunda	0	2	2

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Table 52. Continued.

Scientific Name	Nuku'alofa	Rural	Total
Rhus taitensis	1	0	1
Cerbera manghas	1	0	1
Pritchardia pacifica	1	0	1
Albizzia lebbeck	1	0	1
Salix sp.	1	0	1
Xylosma orbiculatum	1	0	1
Pittosporum arborescens	1	0	1

241 are an integral part of the Tongan agricultural system and constitute a valuable source of staple and supplementary food crops and numerous other valuable plant products. 241 369 In the Nuku'alofa area, there seems to be much more intensive cultivation or protection of short - term food crops and other non - food plants. [245] No appreciable difference in the frequency of cultivation or protection of valuable trees species between the Nuku'alofa and rural town allotments was found.

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244 Other important subsistence crops, sometimes planted alone, al-
245 though generally interplanted with the above crops, were giant taro (Alocasia macrorrhiza), plantains (Musa paradisiaca), bananas (Musa sapientum), and Goa yam (Dioscorea
[128] esculenta). Excluding coconut palms, which were considered a tree crop and did not enter into the acreage estimates, bananas (in plantations) comprised 42 percent of the commercial acreage with the balance being made up by other commercial crops such as watermelons, pineapples, peanuts, plantains, corn, and garden vegetables.

Intercropping is most widely practiced with subsistence crops. Yams are almost always intercropped, mainly with giant taro, American taro, swamp taro, and plantains, and occasionally with bananas or Goa yams. Swamp taro and American taro are often intercropped, and manioc and sweet potatoes are rarely intercropped with other species. Only limited intercropping is practiced with commercial crops, although in a few cases taro was planted under bananas, pineapples under manioc, and watermelons among yams.

241 Cropping sequences usually last from two to five years, after which the land is left fallow from two to six
241 years. After clearing the secondary vegetation and asso-
244 ciated intercropped species, yams are usually the first crop planted. American taro generally follows yams and in turn is followed by manioc before the land is allowed to

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244 revert to fallow. Sweet potatoes also enter into the sequence, especially in sandy areas. Manioc and taro are commonly replanted on the same plot, in the case of manioc up to four times, before the plot, along with relicts of the taro and/or manioc, reverts to fallow. A great variety of
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245 sequences are practiced by farmers, and more recently,
[244] commercial crops such as watermelons and bananas often begin a sequence or are integrated into one. In the case of bananas, the sequence is often broken and with the benefit of fertilization the crop will remain on a given plot for a number of years.

241 In addition to these major staple and commercial crops there is also a great range of other important supplementary food plants, useful non-food plants and trees which are either cultivated or protected in a wild state on bush allotments.

With the exception of _Cordyline terminalis_, the cherry tomato (_Lycopersicon esculentum_ var. _cerasiforme_), and the chile pepper (_Capsicum frutescens_), which are usually protected as volunteers, the most important supplementary food plants are papaya (_Carica papaya_), edible hibiscus (_Hibiscus manihot_), sugar cane (_Saccharum officinarum_), and _kava_ (_Piper methysticum_), all traditional components of the Tongan agricultural system. Other crops of more recent introduction, include corn (_Zea mays_), onions (_Allium spp._), pumpkins, (_Cucurbita pepo_), and passion

241 fruit (Passiflora spp.)

[247] [248] Of the non-food plants which are cultivated and protected, the most common are a number of species of Pandanus and paper mulberry (Broussonetia papyrifera). There are also numerous other plants which are cultivated or protected because of the value of their fruit, flowers, leaves, roots, bark, and wood for such purposes as the preparation of handicrafts, folk medicines, dyes, scented coconut oil, decorations, and adornment (Appendix E).^A

241 245 Although the major staple and commercial crops tend to dominate the cultivated acreage of bush allotments, the most prominent plants are usually coconut palms and a great range of important tree species. The coconut palm, which was present on over 90 percent of the surveyed bush allotments, is by far the most common and most important cash crop on Tongatapu as well as being of considerable subsistence value. On allotments without palms, insecurity of tenure, unsuitable soil, and the threat of frequent fires were often the reason for their absence. 50 percent of the allotments also had newly planted palms.

Other useful trees, primarily important because of their edible fruit, which seem to be present on over half of Tongatapu bush allotments, include: mango (Mangifera indica), citrus trees (Citrus spp.), tava (Pometia pinnata), breadfruit (Artocarpus altilis), Tahitian chestnut (Inocarpus edulis), and guava (Psidium guajava). Other

A[See Category 116, pp. 377-431—Analyst.]

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245 common species include avacado (Persea americana), Indian almond (Terminalia catappa), soursop (Annona muricata), Polynesian vi-apple (Spondias dulcis), the Malay apple and rose apple (Syzygium malaccense and S. jambos). More recent introductions such as cocoa (Theobroma cacao), cashew (Anacardium accidentale), fig (Ficus carica), apple (Malus pumila), and peach (Prunus persica) were also found on some allotments.

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137 Of even greater importance in numbers and frequency of occurrence are at least 67 other tree species, all useful in some way to the Tongan society. They are generally found in a protected state although sometimes deliberately planted. Apart from the value of their timber, these trees are useful in the preparation of medicines, dyes, handicrafts, cordage, scenting for coconut oil, soap substitutes, handicrafts (including carving), canoe construction, and other material goods (Appendix E).A The most common trees in this category include Bischofia javanica, Aleurites moluccana, Hibiscus tiliaceus, Morinda citrifolia, Macaranga harveyana, Rhus taitensis, Grewia crenata, Erythrina variegata, Pandanus tectorius, Glochidion spp., Ceiba pentandra, and Santalum yasi. A vast majority of these tree species found on bush allotments are native to Tonga, although some recent introductions such as Ceiba pentandra, Cananga odorata, and Plumeria acuminata are also common.

A [See Category 137, pp. 377-431--Analyst.]

241 242 [654] lablab to improve fallow vegetation as well as an increasing use of inorganic fertilizers. In most cases, however, fertilizers were supplied by the Coconut Replanting Scheme or the Agricultural Department for use with coconuts, bananas, watermelons, or export vegetables, rarely for subsistence crops. The practices of mulching or use of animal manure were seldom employed.

241 407 The use of plows and disc harrows for the clearing and preparation of land was common, and approximately one-half of the allotments have been plowed at one time or another. 241 [654] In most cases, however, plowing was done under the auspices of the Coconut Replanting Scheme. [244] Commercial crops such as peanuts and watermelons were often grown on plowed land, but plowing for staple root crop production was uncommon.

[244] Most staple crops were well weeded, except for manioc and taro which seemed to compete successfully with weeds. 241 245 Commercial crops also seemed reasonably well cared for, except in the case of pineapples which were often overrun by secondary growth and some banana plantations where proper desuckering was not practiced and diseased plants were poorly weeded.

241 245 136 Tree crops, however, received very little attention, and coconut palms, both mature and replanted, were often found overrun by secondary vegetation, burned around the bases during clearing, or left prey to rat, rhinoceros

241 245 [136] [231] beetle, and coconut stick insect predation, with little or no attempt at control. The damage caused by these pests, plus damage to young palms by fire and escaped or grazing livestock, was considerable.

241 241 654 Pest control, in general, was rare except for commercial crops. Here the purchase of pesticides, fungicides, and herbicides was usually borne or at least subsized by the Agricultural Department or the Commodity Boards. In the case of control of black-leaf-streak in bananas, misting oil was actually applied by Department of Agriculture personnel.

241 312 Formal irrigation systems were rarely if ever found on bush allotments, and simple wells were found on only about one-tenth of all bush allotments. The use of water for irrigating short term crops such as vegetables and watermelons generally required carrying water in drums from the town allotments or from nearby wells.

241 242 The effect of the "Green Revolution" seemed to be almost non-existent. Although the Government Experimental Farm has successfully grown a wide range of new plants such as sorghum, soybeans, rice, and macadamia nuts, very few have been integrated into traditional cropping sequences. In some cases, garden vegetables such as tomatoes, capsicum and bulb onions were planted, but these often required additional non-traditional and expensive inputs such as fertilizers, insecticides, fungicides, and irrigation.

241 417 [245] Fencing, generally to protect crops such as paper mulberry (Broussonetia papyrifera) from destruction by livestock, was found on a number of bush allotments. On 10 percent of the sample allotments good condition barbed wire fencing was used around at least some portions of the land. On others, poor quality fencing or live fences and hedges were found; Erythrina variegata and Jatropha curcas were commonly used.

241 361 [231] Permanent residences were found on 13 percent of the sample bush allotments. These allotments were generally more intensively cultivated and fruit trees, useful plant species, and livestock were comparatively numerous. Temporary thatched houses were found on many bush allotments; these are generally used in guarding valuable crops.

241 231 [262] In some cases, livestock, primarily horses and cows, were tethered or allowed to graze on bush allotments. Most livestock, especially pigs, chickens, ducks, goats, and dogs (which are commonly eaten) were generally kept on town allotments. In almost all cases where these animals were found on bush allotments, the farmer's permanent residence was situated there also.

241 178 [137] In short, the agricultural system, as practiced on bush allotments, seems to have retained much of its traditional character. The types of crops and protected plants, intercropping practices, and plant successions have undergone few major changes. Some changes which have taken

241 range of subsistence products.

241 The average town allotment generally has at least one
351 main dwelling or sleeping house (*fale mohe*) plus a number
[342] of other structures, such as separate kitchens (*peito*),
[343] wash houses (*fale kaukau*), outhouses (*fale vao*), and in
[369] some cases pig sties. On a majority of the town allotments
in Nuku'alofa, and to a lesser extent in the rural villages,
fences were found around the entire allotment or around
[417] portions used for keeping livestock. Fences for livestock
[245] were usually of barbed wire. Those which were more ornamental or used to delineate property boundaries were often
living fences or hedges, most commonly of *Hibiscus spp.*
241 and *Nothopanax spp.* Wells, rainfall catchment systems, and
312 private water pipes were common on town allotments in
369 Nuku'alofa. In the rural areas, water was generally
obtained from centrally located village water pipes.

241 Within this setting, a great variety of livestock,
231 staple crops, and other valuable plants and trees were
found. Almost all allotments had some livestock; over
half had chickens, dogs, and pigs, while horses, cats, ducks,
241 goats, and cattle were found on several. In Nuku'alofa, the
231 law prohibits pigs and other animals except poultry roaming
369 free. On rural town allotments, however, over half of those
sampled had loose pigs. These constitute a major deterrent
241 to the cultivation of certain crops. Staple crops were
369 cultivated in limited acreages on about half of all town

241 allotments in the urban area of Nuku'alofa but to a lesser
369 extent in the rural villages. The most common staple crops
241 found included swamp taro (Colocasia esculenta), American
244 taro (Xanthosoma spp.), giant taro (Alocasia macrorrhiza),
[245] and bananas (Musa sapientum), plantains (Musa paradisiaca),
and the pata variety banana (Musa sp.), none of which are
usually planted as commercial crops on town allotments.
Of lesser importance on town allotments were manioc, yams,
and sweet potatoes. Swamp taro, which was not as important
on bush allotments, was the most frequently planted crop on
town allotments, especially in Nuku'alofa.

241 There was also a great range of supplementary food
crops and valuable non-food plants that were cultivated
and/or protected. The most common of these were chili
pepper (Capsicum frutescens), edible hibiscus (Hibiscus
manihot), sugar cane (Saccharum officinarum), si (Cordyline
terminalis), kava (Piper methysticum), pineapple (Ananas
comosus), passionfruit (Passiflora maliformis and P. edulis),
lemon grass (Cymbopogon citratus), and grenadilla
(Passiflora quadrangularis), introduced vegetables such as
tomatoes (Lycopersicon esculentum), pumpkins (Cucurbita
pepo), and eggplant (Solanum melongena). Of the 28 diffe-
rent useful non-food plants found on the town allotments,
the most common were species of Pandanus, Gardenia jasmin-
[369] oides, Gossypium brasiliense, and Coix lachryma-jobi. Both
supplementary food plants and non-food plants were much

241 369 more frequent in Nuku'alofa than on the rural town allotments.

241 245 [369] The most impressive vegetational feature on town allotments was the great range of valuable tree species that are cultivated and protected. These included over 75 different species, some of which were found on a majority of all town allotments. The most frequently occurring species were fruit trees such as breadfruit (Artocarpus altilis), mango (Mangifera indica), coconut (Cocos nucifera), tava (Pometia pinnata), and citrus trees (Citrus spp.). Some of the more important non-fruit trees included Plumeria spp., Hibiscus tiliaceus, Aleurites moluccana, Ceiba pentandra, and Pandanus tectorius. There seemed to be no marked difference in the frequency of occurrence of these trees between Nuku'alofa and rural town allotments.

241 [351] Fallow or secondary vegetation was almost nonexistent, except where there were uncut weeds or poorly maintained gardens. Most areas not occupied by structures, cultivated plots, or trees generally consisted of mowed or cut weeds which served as a lawn.

241 369 The town allotments, especially in the urban area of Nuku'alofa, seemed to constitute a very important source of food and other subsistence products. The range of crops, protected plants, and trees is similar to that found on bush allotments although town allotments have more recent introductions than bush allotments. And finally, livestock

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435 **Increased Coconut Acreage**

Owing to the continued efforts of the Coconut Replanting Scheme and the high copra prices in 1974, there should be a major increase in the acreage of systematically planted coconut palms in the next five or ten years.

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654 **Possible Expansion of Livestock Husbandry**

Because of government livestock subsidy schemes, there is likely to be an expansion of livestock husbandry 311 and pasture improvement. The expansion of pig and poultry 312 husbandry seem to offer the best prospects because of the limited land area and water resources on Tongatapu. 000 Accordingly, Hardaker (1971:70) discouraged a widespread expansion of cattle ownership.

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178 **Declining Soil Fertility**

Owing to the increasing cropping period and associated decrease in the fallow period, the inherent soil nutrient status and structure of Tongatapu soils have deteriorated considerably. In almost all cases, today's farmers feel that farmers of previous generations received much 241 higher yields due to more fertile soils. The relative 134 amounts of nutrients stored in fallow vegetation depend on the extent to which trees and shrubs have been destroyed, because grasses and herbs store relatively smaller quantities of nutrients. As a result, there is less addition of humus and nutrients to the soil both through litter and root production and through burning. Furthermore, the

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> trained Tongans, he pointed out that he was not capable of developing the enterprise further through independent, sober, regular work like a European, that a decline would have to be reckoned with and that he would request that a European be retained for this position.

181 461 245 178 However, there has been a change insofar as a new type of work involving all kinds of effort, namely copra production, has spread in Tonga to the smallest inhabited island, and along with it has come the thinking in terms of money which has given a certain impetus to increased work in order that the desired goods could be bought and the customary, often large church contributions, as well as the taxes could be paid. However, the copra work has not been a strong enough influence to upset the Tongan rhythm of life and work. This fact must, in the first place, be traced back to the imperturbable, stoic nature of the Tongans. (39)

> 39. Even today many coconuts on the Tongan plantations rot because the owners do not happen to "feel like" gathering them.

Secondly, the number of coconut palms on every plantation is naturally limited, so that the respective copra production cannot exceed a certain optimum (which is, however, almost never reached). Furthermore, as has been mentioned, the actual, natural needs of these islanders are small.

181 461 177 /27/ A few Tongans working for Europeans have, however, become accustomed to a different pace of work which is marked by certain haste and restlessness. (40)

> 40. For example, the author noticed one Tongan who for some time drove a bulldozer for the Americans on the Tongatapu airport; another who, as house painter (partly for piece-work wages) and auto mechanic, earns a considerable amount and, with an old truck, established an "independent trucking business."

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368 there are three churches (party in Tongan style) in the settlement inhabited by only 200 natives.

[366] In addition, a village has a government school and often a Wesleyan school as well, one to four kautaha houses (meeting place of the women's cooperative for tapa- and mat-making) and one to four small (retail) shops.

361 351 Although most of the houses are situated on the roads that intersect the villages, their distribution seems irregular. The broad grassy areas (265)

[245] 265. These are often interspersed with mango and bread-fruit trees.

on which they are situated are (in accordance with the law) cut short by the natives, but are often untidy looking. Since most individual plots are not fenced in and the neatly plaited fences of plantations and houses praised by observers in old times have long since been forgotten the villages give an even more unkempt impression.

361 178 [491] These villages are a development of more recent times. In ancient Tonga the houses of commoners were scattered throughout the islands; people lived on their plantations, (266)

266. Ellis writes, for example: "The houses do not form towns or villages, but are built about five hundred yards or more from each other and generally in the midst of a plantation, the whole of which is frequently fenced in with a hedge of bamboo, or reeds with a door-way"; /cited in English/ (W. Ellis, An authentic Narrative.../cited in English /. loc. cit. I. 1782 pp. 88/89.

and many roads made possible easy connection between the plantations. (267)

267. Reminiscent of this old way of settlement are the huts on individual plantations found even today on various islands, which are very

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241 for the accidental green manure from decayed parasites on banana trunks and the ashes from burning the slashed and dried wild plants when the land is cleared. The apparently recent but /156/ obvious exhaustion 241 242 (134) of the soil on several Ha'apai islands, (412)

> 412. It is impossible for many land-poor Tongans always to observe the necessary period of fallow.

leads to the fact that here the less exacting, "new" manioc plant is in places planted more abundantly than the demanding yam; on Nomuka, for example, yam cultivation ceased altogether for a time until it was discovered in 1943 that the plant flourished once again. It was on this particular island that the Forsters (413)

> 413. G. Forster, loc. cit. V. p. 150.

saw an abundance of harvested yams.

242 The planting together of various crops on the same land (for example, yams with bananas, sweet potatoes with kape and bananas) is a procedure already practiced in ancient Tonga, (414)

> 414. See, for example, J. Cook, Beschreibung... loc. cit. VI. p. 284.

and is apparently based on early experiences of biological suitability. 241 245 178 656 The planting of coconut palms has, however, as a result of copra production by the natives, become greater than in the past; the government prescribed division of the api'uta into half for coconut palms and half for crops has on some islands shifted to such an extent that some plantations are covered up to seven-eighths with coconut palms in between which bananas, kape, taro, manioc, etc. flourish.

412 241 177 The tool the Tongans use for cultivation has changed as a result of European influences, insofar as the old wooden digging stick (huo) that was flattened at the end and was not much wider than two to four inches (415)

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244 convenient method is to loosen the soil with the huo lafa-lafa (or a European pitchfork), break it up and shove the plant section into it. The distance between plants is about one meter. Every two weeks or so the taro plant is weeded with the huo lafa-lafa. After about a year, often two years or even three to six years, the harvest takes place, at no particular time of year. They cut the stalk with the huo spade close to the ground, then dig out the tuber--around the stub from the outside inward--and carefully feel with their hands to salvage all the tubers. The following are other harvest methods: After cutting the stalk they split the exposed parent tuber with the huo spade by a perpendicular thrust, hoist up the two halves and then dig further with their hands to free the tubers. They also simply tear the plant with the parent [262] tuber out of the ground. During periods of food scarcity the stalk of the plant is sometimes also eaten.

● 245 hopa, pata, siaine = Bananas (Musa species)

[262] Bananas have been planted in Tonga since ancient times. Cook refers to them as the most important food plant, along with yams. (424)

424. See, for example, J. Cook, Beschreibung... loc. cit. VI. pp. 163, 236, 283.

Today too /162/ bananas belong to the major crop on all the islands of the Archipelago in terms of providing food for the inhabitants. Several varieties of bananas have long been planted on the Archipelago. (425)

425. Cook mentions, for Tongatapu, "fifteen varieties" of the "pisangs" (J. Cook, Beschreibung...loc. cit. VI. p. 236).

[137] It is not clear whether the siaine, which the natives throughout the Archipelago are not fond of eating, is a strain introduced under European influence.

[221] Bananas can be planted all year long. The natives like to plant them individually in yam, kape, taro or manioc "gardens"; but they also lay out special banana plantations, as in the days of Cook. With the

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245 huo spade they dig holes approximately 50 centimeters deep (diameter 25 to 30 centimeters) in which they plant a sprig (root sucker). They fill the plant hole with earth so that a depression remains in which water from rainfalls can accumulate. The distance between plants is about five meters on a flat area. Every three weeks or so they remove the proliferating weeds with the huo lafa-lafa. After six to nine months the first fruits can be harvested.

niu = Coconut Palm (Cocos nucifera L.)

824 178 Since the settlement of the Archipelago the coconut palm has played a very special role in Tongan culture. At the present time in particular, in view of its extraordinarily manifold uses, (426)

426. The following list will show the all-purpose uses of the coconut palm in Tonga; ("old") and ("new") indicate whether or not its utilization was already common in ancient Tonga.

(262) (252) (231) (303) (372) 1. The meat of the nut (kakano 'i niu): eaten in pieces by the natives (old); grated (or squeezed out as coconut milk) for preparing foods and beverages (old); grated to feed chickens and pigs (old), used in pieces to feed pigs (old) and horses (new); used for making copra (new); the oil obtained from the meat is used to make hair oil and body oil (lolo Tonga) (old), to fry in a pan (new) and to burn as fuel in the absence of petroleum imports (old).

(272) (262) (264) 2. The water of the nut (huhu'a oe niu): especially of unripe nuts is drunk by the natives (old); in an unripe nut it is stirred together with the meat and eaten (old); used at meals to wash one's fingers (old).

(415) (372) (524) 3. The hard shell (Endocarpium) of the nut (nge'esi niu): used for making drinking mugs (old); as fuel (old) and (as charcoal) to heat flat irons (new); used as a child's toy su nge'esi niu ("coconut shell shoes," see p. 272 (new).

(283) 4. The husk (Mesocarpium) of the nut (pulu): used to make cord (kafa) for house and boat building, for fastening blades to tools etc. (old); used as cover for hatchets

/162 cont./

824 (old); serves to deep fire smoldering (old); as
178 fuel (old). "Towel" (old), "toilet paper" (old)
(372) and to clean shoes (new): the fibers are also used
to press out the grated coconut meat (old); the
(752) juice of green, warmed husks and the crumbly material
(524) between the fibers of old husks are used to treat
wounds (old); used for making children's toys
(sailboats) (new?).

(352) 5. The palm leaves (*lou niu*): used, as is, to sit
(285) on in the bush (old); used to make floor mats
(*takatapu*) (old), fans (old), baskets (old), hats
(372) (for example, *helemeti* and *tata faka-polis*) (new);
needed to make house walls and roofing (old); used
in dry form as fuel (old).

(285) 6. The center rib of the leaflets (*tu'a niu*): used
(287) in plaiting baskets (old) and fans (old) and in making
(412) tapa stencils (see p. 328); used in making brooms (old).

/163/

7. The leaf stems (*tome*): used as carrying sticks
(482) (see p. 250) (old); in dry state as fuel (old); also
(372) used to keep fire going (smoldering leaf stem wound
with tapa) (old).

(287) 8. The bast fiber at the base of the leaf stem (*kaka 'i
(415) niu*): used to make tapa stencils (under side) (old) and
as a bag for squeezing medicines and food (old).

9. The wood or the trunk (*sino oe niu*): used to make
(313) rafters and roof laths (old); used as posts and beams
in houses (old?), as single posts on the plantations and
for palisades (old).

(278) 10. The bark (*kili oe niu*): used to make medicines
(for stomach pains) (old).

(227) 11. The roots (*aka oe niu*): used to plait fish baskets
(traps, *finaki*) (old) and to make cuttle fish hooks
(278) (tailpiece) (old); the juice of roots serves as medicine
for abdominal pains and headaches (old).

it maybe designated as the most useful plant of the /163/ Tonga Islands.
245 Cook reports that he came across coconut palms on Tongatapu "in astonishing numbers." (427)

427. J. Cook, Beschreibung...*loc. cit.* VI. p. 237.

/163 cont./

245 This impression may be confirmed today for the entire Archipelago. [178] Very likely the present number of coconut palms in Tonga (estimated at over three million) is far greater than it was in the past, since a new type of utilization was added to the old possibilities, namely, copra production. (428)

428. See p. 298 ff.

For this the natives use up 70 to 80 percent of all harvested coconuts.

It is precisely about the cultivation of the so useful coconut palm that the Tongan is the least concerned. He scarcely clears a larger area for systematic planting, but rather, wherever on his land coconut palms would seem desirable for him, he digs small holes (diameter approximately 30 to 40 centimeters) and places in each a completely ripe coconut (in any position). No further care seems to him necessary. Some natives simply throw the nuts they have set aside for planting on the ground and the undemanding plant seems to thrive [221] even then. The "planting" of coconut palms is not restricted to any special time of the year. After seven to eight years the young palm yields the first nuts. Coconut palms, which grow by themselves or with mixed cultures (bananas, kape, taro, manioc), reach an age of over 100 years, though their production of nuts gradually decreases during the last decades of their lives. Since the ripe nuts are gathered only on the ground and one can then usually not determine from which palm they came, one cannot give any figures for Tonga about the annual production [481] of he individual palm. To pick the young "drinking" nuts the natives climb up the coconut palms in the traditional manner: while grasping the trunk they "shinny" up and need no special mechanical aids. For climbing younger palms, however, the bad habit of cutting footholds into the trunk (with the machete) has occasionally been resorted to.

mei = Breadfruit Tree (Artocarpus altilis)

[262] The breadfruit tree was likewise widespread in ancient Tonga. Cook

/163 cont./

245 262 and Ellis mention it among the essential food plants of the natives. (429)

429. See J. Cook, *Beschreibung*...*loc*. *cit*. VI. pp. 236, 284; W. Ellis, *An authentic narrative*... I. p. 89.

It is to be assumed that today the importance of the breadfruit for the food of the Tongans corresponds approximately to that of Cook's time. As Cook already recognized, (430)

430. J. Cook, *Beschreibung*...*loc*. *cit*. VI. p. 189.

there is a particular "breadfruit period" in ever year during which this product replaces all other cultivated products in the meals of the Tongans. (431)

431. See p. 277 ff.

245 Breadfruit trees, of which there are eight varieties in Tonga today, grow mostly wild on the islands. The natives, however, who took them into their villages, in accordance with their old custom of planting "bread trees...all around their dwellings" (432)

432. J. Cook, *loc*. *cit*. VI. p. 163.

also set them out on their *api kolo*. They dig a large hole in the ground in proportion to the roots of the tree they are going to plant (for example, one and one-fourth meters deep and one meter in diameter) and plant a young, wild breadfruit tree, a year or more old, which they have fetched from their plantations. As in the case of banana and taro planting, they fill up the hole leaving a slight depression around the
[221] trunk for rain water to collect. Planting time is all year long. The
[262] first fruits ripen after about three years. The principal harvest time are the months of March to May, and then the breadfruits, which are usually knocked off the trees with long poles, dominate Tongan cooking.

mango = Mango Tree (*Mangifera indica* L.)

It is not clear whether this tree has been indigenous to Tonga for

/163 cont./

245 [221] [262] a long time. It grows wild in the bush (plantations) and, like the breadfruit tree, is also planted. Principal harvest time is November-December. The fruits are much liked by the Tongans.

koane = Maize (*Zea mays* L.)

[137] This plant, introduced in Tonga by Europeans, seems the most suitable species of grain for this climate, but has attained little importance on the islands.

249 *to* = Sugarcane (*Saccharum officinarum* L.)

is an ancient Tongan cultivated plant (433) and thrives on the islands. Since the Tongans, however, do not engage in sugar production and no industry of this type was established in the Archipelago by Europeans, the planting of sugarcane has remained very limited.

433. See J. Cook, *Beschreibung*...*loc. cit.* VI. p. 284; W. Ellis, *An authentic narrative*... I. p. 89.

244 *hina* = Pumpkin (*Cucurbita pepo* L.)

[137] [262] was introduced by Europeans in Tonga. It is planted and also occurs in the wild state, but is not much liked by the natives.

meleni = Watermelon (*Citrullus vulgaris*)

[137] [262] likewise came to the Archipelago through European influence. It is usually planted, but is also sometimes found growing wild. The Tongans like to eat watermelon, but they have not yet cultivated this plant extensively. /165/ On many islands the melons are also destroyed by harmful insects.

faina = Pineapple (*Ananas comosus*)

[137] [432] This cultivated plant, also introduced by Europeans, has become quite popular, yet it is by no means commonly planted. On the main islands the natives like to plant pineapple to sell. As a result of the negligence of the natives and the unfavorable location of the plantings (in part far from the villages), the pineapple is often

/165 cont./

244 hindered in its growth by weeds or is eaten by horses and rats.

pinati = Peanut (*Arachis hypogaea* L.)

[137] This was also brought to Tonga by whites. The natives are fond of
[262] peanuts, but have so far paid little attention to its cultivation

245 *moli* = Orange, Lemon, Grapefruit, Tangerine (*Citrus* species)

[137] Some of these grew in the Archipelago even in olden times (grapefruit!) (434) and were in part introduced by Europeans. These fruits, with the exception of lemons, are very popular among the Tongans. The *moli* are planted in the villages as well as on plantation lands, but there they mostly
[136] grow wild. On many islands a fruit fly has caused considerable damage to oranges.

[137] *lesi* = Papaya (*Carica papaya* L.)

was apparently introduced by Europeans, but a long time ago. Today it is widespread in the Archipelago, grows wild, but is also planted in
[262] bush land and sometimes in the villages. The natives are fond of the
[252] fruit (raw, cooked or steamed in the earth oven).

fekika = Malayan Apple (*Eugenia malaccensis* L.)

has probably been indigenous since ancient Tongan times. (435) Some of the trees grow wild in the *api 'uta*, some are planted there.
[262] The Tongans love the fruit, but today, as in the past, it is not very important in their diet as a whole.

241 *vi* = (*Spondias dulcis* Forst.)

seems to be indigenous in Tonga and largely grows wild on plantation
[262] lands. The natives like the sweet fruits.

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434. See G. Forster, *loc. cit.* V. p. 150; J. Cook, *Beschreibung*...loc. cit. p. 236.

435. Perhaps Ellis means the Malayan apple when he says: "a fruit resembling an apple, which we never saw ripe" /quoted in English/ (W. Ellis, *An authentic narrative*...I. p. 89).

/165 cont./

245 tava = (Pometia pinnata Forst.)

[137] is said to have been brought to Tonga from the Fiji Islands. (436)

436. See Th. West, Ten Years.../cited in English/ p. 133.

[262] The tree occurs in the wild state and is also specially planted. The fruits are popular among the natives.

/166/ ifi = (Inocarpus fagiferus [Park.] Fosb.)

occurred already in ancient Tonga. (437)

437. See J. Cook, Beschreibung...loc. cit. VI. p. 284.

[262] [252] The tree is planted, but also grows wild. The natives cook the fruit and also steam it in the earth-oven, in the traditional way.

241 vaine = (Passiflora speices)

[137] [262] was brought to the Archipelago by Europeans. The fruits of the vaine are generally planted, but also grow wild, and are eaten raw.

apele Tonga = (Annona reticulata L.)

[137] [262] probably also came to Tonga through European influence. The apele Tonga is sometimes planted, mostly grows wild. The fruit is eaten raw.

'avoka = (?)

[262] was apparently likewise introduced in Tonga only a few decades ago. On some of the islands the natives like to plant 'avoka, but it also grows wild. The fruit is eaten raw.

244 si = "Sugar Tree" (Cordyline terminalis)

is a plant that was already indigenous in ancient Tonga. (438)

438. See J. Cook, Beschreibung...loc. cit. VI. p. 284.

[252] The si are often planted on the api 'uta, but also in the villages; moreover, they grow wild. The root is used: it is steamed in the earth-oven to obtain the sweet juice (by chewing or pressing). The importance of this plant has probably decreased, since today the natives on all the islands can buy cane sugar cheaply from Fiji.

244
137 Cabbage, Onions and Tomatoes,

/169 cont./

231 According to these figures, pigs and chickens, the domestic
184 animals of ancient Tonga, occur most frequently in 'Uiha and Fungamisi.
The difference with respect to the rest of the domestic animals is
more striking in 'Uiha than in Fungamisi. In the latter village, its
231 184 nearness to the seaport of Neiafu is a factor; the natives probably
432 feel it is more profitable to use their coconuts for copra production
(245) (the copra receiving station of the government is not far from the
village) than to breed pigs more extensively, especially since the
latter can be replaced by corned beef and salted meat which is easily
obtainable in Neiafu. The cattle raised in Fungamisi can be profitably
sold to merchants in Neiafu.

231 In general, there is no intensive animal husbandry in Tonga, such
as the European is accustomed to. Stalls and fenced-in areas are
(272) (262) practically unknown. /170/ Milk, eggs and manure are not used. The
(237) following survey may give an idea of animal husbandry in Tonga:

Pig:

231 This domestic animal of ancient Tonga no longer exists in its
136 original form. Sailors, missionaries, other whites living in Tonga,
as well as members of the Tongan government have, in the course of
time, brought a number of pigs of various strains to Tonga. This
seems to have improved the old Tongan breed of pig which was
probably smaller. A clear racial identification is no longer
possible because of the various crossbreeds.

231 Pork is by no means a daily food; the natives usually slaughter
262 the animals only for festivals and other special occasions (for
574 example, a visit of a member of the royal family), just as was
customary among commoners in the past. (450)

(113) 450. See W. Waldegrave, Extracts from a private journal.../cited in English/ p. 187.

/200 cont./

262 432 sour and sweet hard candies, which, like chewing gum, may be obtained from shopkeepers on most of the islands.

272 432 Tea, coffee and cocoa, though they may be bought today on many islands of the Archipelago, have not attained great importance for the Tongans. (522)

522. See chapter on "Food," p. 275 ff.

273 [439] [656] The natives cannot easily obtain alcoholic beverages (kava papalangi). Limited amounts are probably imported, but only a few Tongans have the required permit from the minister of police that entitles them to one bottle of spirits per month. On the black market the natives obtain only very small quantities of alcohol. [177] Various Tongans have become experienced in making alcoholic beverages (using, for example, sugar [or artificial honey], yeast and pineapple), especially through their contact with foreign troops on Tongatapu [687] during the second World War. But this illegal production that can be punished by imprisonment has heretofore been proportionately small, chiefly around Christmas time, and of late it has become insignificant.

276 177 Thus, European influences in the area of luxuries have brought about a certain change, chiefly through the importation of tobacco. But, although most Tongans enjoy smoking, they have not become so addicted to tobacco that they are actually dependent on it; (523) this is, of course, also not the case with the other new and less important luxuries.

523. For example, on the small islands, shopkeepers often run out of tobacco, and the Tongans who then lack smoking supplies usually bear the time they must wait for a new shipment with equanimity.

C. Copra Production

245 177 Copra production (524)

/200 cont./

245 (177) 524. Copra is the cut-up and dried kernel meat (endosperm) loosened from the hard shell of the ripe coconut.

is a relatively new activity for the Tongans, which goes back only to contact with Europeans and is today carried out on all the inhabited islands of the Archipelago. The work itself, as well as particularly the money made from it, influence the life of these natives to a certain extent.

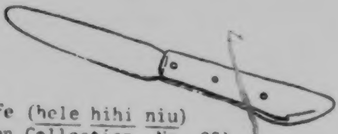
/201/The work of copra production in the Tonga Archipelago proceeds as follows: On his plantation the native gathers the ripe nuts that have dropped from the coconut palms. He usually takes these (492) to his place in the village in his own or a borrowed horse cart, (525)

525. See p. 256-258.

or he carries out the entire process of copra production directly on his plantation, especially if he has a little drying hut and the distance to the village seems too great. In sunny weather he splits 245 412 the nuts (which are still encased in their fiber husks) with an axe into two halves and spreads out rather large quantities of these, with the meat side up, to dry in the sun. After two or three days, (526)

526. In bad weather, or at night, he turns the halves upside down and places them slatwise against each other so that they form chains and the rain can run off the rounded outer sides.

he takes the meat (in larger or smaller pieces) out of the hard shells with the copra knife.



Copra knife (hele hihi niu)
(Expedition Collection, No. 95)

/201 cont./

245 The copra knife (hele hihi niu) is about 35 centimeters long; the
412 wooden handle and the steel (iron) blade are each one-half the total
[432] length The natives usually buy the knife in the shops of the chief
towns and then replace the handle with a self-made one (of feta'u wood=
[824] Calophyllum inophyllum) that has a longer, slanting end so that the
[325] hele hibi niu can lie more comfortably in the hand; sometimes they also
make the entire knife themselves by heating an old blade or corresponding piece of metal in the fire, shaping it with hammer blows on a hard stone, then working it with a file and finally giving it a wooden handle which they attach with nails.

245 Afterwards, they dry the meat in special drying huts (fale fakamomoa niu) for approximately 24 - 36 hours.

245 The drying huts "German New Guinea type" /cited in English/ were
258 not introduced in Tonga until after the second World War. The natives
themselves build them. On top of an iron cask lying on the ground and open at both ends (or on two /202/ casks joined to form a longer tube) they place a wooden grate (with an interspace of about one-half meter). The whole is encased in longitudinal walls and a roof of plaited coconut leaves. In the cask (or casks), which sometimes also has a side vent, a fire is built, fed with coconut husks and shells, which produces great heat and little smoke and dries the meat spread out on the grate.

245 Thereafter, the natives cut the coconut meat into still smaller
258 pieces, spread these out once more in the sun for a day; finally, they
432 fill bags with them and store them in the storage hut or the dwelling
until there is an opportunity to drive or sail to the nearest receiving station of the Tonga Copra Board /cited in English/; if they near such a station they simply fill their traditional coconut-leaf baskets with copra and take them immediately to be sold.

/202 cont./

245 [462] [857] [887] The entire copra production is carried out chiefly by the men. However, women and girls often help and even do such heavy work as splitting open the nuts and removing the meat. Children and old people of both sexes take part as far as they are able, especially in the easier tasks.

245 258 Copra is not always and everywhere prepared in this way; the drying huts are more widespread on some islands than on others, and a number of Tongans, limit themselves to drying the meat of the coconuts in the sun for several days. It is only since the second World War that the Tonga dry the copra themselves. Before that the white dealers bought the cut-up coconut meat from the natives and dried it at their trading stations. Since they often bought large quantities and their storage places were limited, they were not always able to handle the copra carefully, and particularly during prolonged rainy periods they stacked the "green copra" and the "dried copra" in alternate layers in their warehouses, in order to dry the former. This method often resulted in a dark and slimy product. Through the creation of the [435] Tonga Copra Board /cited in English/, which permits the natives to carry out the drying process themselves and gives them a stimulus for good work by staggering the prices (for A, B and C quality), Tongan copra has improved a great deal and has risen from almost the poorest level of the entire Pacific to approximately Ceylon-quality.

423 425 245 656 According to present-day law, which has superseded the arbitrary power of chiefs, every Tonga who is granted an api'uta (527)

527. See pp. 172-173.

must plant 200 coconut /203/ palms. In practice, however, there are sometimes more, sometimes fewer palms on the individual plantations, either scattered over most of the api'uta or concentrated on one-half of the land. 245 433 The copra production of individual families remains about

/203 cont./

245 the same throughout the year, since the months in which more nuts fall
433 (summer) they are usually not all gathered, whereas in the periods of rather more scarcity (winter and the dry seasons) the natives seem
245 concerned about every nut. On a plantation of 8¼ acres an average of
433 approximately two tons of copra may be produced in a year; since the
434 price paid by the Copra Board for A-quality was, for example, 62£T.
[435] per ton in 1952, the owner of such a plantation was able to earn about 124£T. (or about 1170 German marks) that year for his copra, if he delivered the best quality. The plantations that are available to individual families, however, differ in size, (528)

528. See p. 173 ff.

so that the profit in terms of money from copra production fluctuates very much among individual households, and at present amounts to perhaps 30 and 300£T. annually. (529)

529. In 1952 in the Vava'u group, for instance, every household made an average of 170£T.

245 Moreover, the price of copra constantly rises and falls on the world
435 market, (530)

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434 530. Before the second World War the price paid for one ton of copra in Tonga dropped to 4£T.

so that the Tongans, with their heavy dependence on copra production as their most important source of money, have experienced "rich" and "poor" periods during the past decades. Nonetheless, with the money
439 they receive for their copra production the natives are able to buy
177 various imported goods which contribute in some respects to a change
511 in their material culture as compared with the past. Most of these goods are not vitally necessary for the islanders, for today all Tongans can still support themselves solely by means of their agriculture (along with their fishing and domestic-animal raising). Since the quantities of bark cloth and mats that were made in the

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/203 cont./ Since the quantities of bark cloth and mats that were made in the Archipelago have long since ceased to be used for clothing, as a result of European influence, but only for the sleeping places and for festive occasions, the natives are obliged to buy fabric for clothing or readymade clothing; (531)

531. See chapter on "Clothing," p. 67.

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they must also pay the relatively low taxes and make substantial contributions to churches. Aside from that, all money--and this is, as a rule, the larger part of the proceeds from their copra work--/204/ is used to buy supplementary European amenities. Among these are, first of all foodstuffs such as canned meat and fish, flour, sugar, etc., luxuries, above all tobacco, furthermore household objects such as lamps (including oil), dishes, bowls and pots, equipment, raw material and tools for building, fishing and woodworking, and finally things which for the Tongans are definite luxury articles, such as bicycles and cabinet-type sewing machines, perfume and powder.

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434
(592)
(461)
(439)
(177)
Thus copra production has exerted a certain influence on the daily life of the Tongans. The whole family takes part in this work--at any rate, in some phases of it; the men devote many hours of the year to it. The money they make with this activity is largely converted into goods that change the external picture of Tongan culture--from clothing and food to house-building and household goods; money and goods also affect the character of the people and their interrelations--though up to now only to a slight extent. (532)

532. See pp. 17-22, 29-31.

(439)
For the Tongans state the duty on the export of copra and the import of goods that results from this is the most substantial source of income. (533)

533. See Colonial Office, Report on Tonga for the years 1950 and 1951 /cited in English/. London, 1952. p. 8/9. Copra export rose to

245 434 [439] /204 cont./

16,704 tons in 1950 and to 19,222 tons in 1951 (ibid., p. 12); only a few white planters are included in these amounts.

245 433 439 Finally, the fact that the Tonga Islands, through their copra production, have become a member (though a small one) of world economy is having a certain political, commercial and, above all, economic importance for the natives, depending on the state of the world market.

245 433 182 178 177 Yet the possibility of producing copra is too limited on the islands, and the traditional economic and communal system of the Tongans is too closely knit, and the people themselves are too even-tempered for this to lead to the destruction of the traditional life of the natives. The old, basic economic structure has remained. Copra and money have become an essential attribute to their former way of life, but still only an attribute that can be renounced, though renunciation would bring with it all kinds of hardships.

D. Plaiting, Knotting, and Tapa-Making

285 [462] Most Tongan women even today spend a large part of their time plaiting, knotting and making tapa.

/205/ Among the plait work, mats are particularly important on account of the labor involved in making them and their significance for Tongan daily life as well as for festivities. The following types may be distinguished: floor mats, seat mats, sleeping mats, belt mats and display mats; the "poia" plaited of coconut palm leaves, which are used to make walls and to cover roofs, are also to be mentioned here. Some of the mat types--because of various raw materials and different ways of making them--must be further subdivided into individual types. The following list may give a picture of how the most common Tongan mats are used and made:

S /296 cont./
T 177 canned goods have even been introduced into their ceremonial life.
178 [262] Food preparation shows many traditional features--as among the Tongans
[252] and perhaps even more so--along with certain innovations (for example
[415] iron cooking pots), and the typical method of eating with one's
[264] fingers has also been retained.--The conservative Samoans have probably
not felt the need for further changes in their tried-and-true methods
in areas relating to their means of subsistence, which, moreover, have
not been influenced very much by Europeans and indeed would be difficult
to change if only because of geographic conditions.

S T 276 In both Archipelagos tobacco, a luxury imported by Europeans, has
177 become quite important; the natives grow it themselves to a large
249 432 extent and also buy it from shopkeepers.

S T /297/ As in Tonga, copra production in Samoa has become a very
245 common occupation, and to this has been added cocoa-growing. However,
S here too these new activities have not brought about much change; there
[434] has been no profit- mania, and the old social system has proved strong
[596] enough to withstand these influences, for the matai take over the
proceeds and use them on behalf of the entire family.

S T The typical women's handwork of tapa-making and plaiting lives
462 on in Samoa--at least with respect to quality--as it does in Tonga.
178 Division of labor according to sex has also scarcely changed on the
463 Samoa Islands; however, in contrast to the development in the Tonga
Archipelago, the social division of labor (titles-untitles) has still
S T been largely upheld. The daily routine has remained basically the
512 same in both island groups, and has been influenced only to a certain
178 extent by new duties and tasks. Land and sea traffic has changed very
S T much in Samoa, as in Tonga, but it is noteworthy that the Samoans build
489 and use the simple outriggers (paopao) and in addition rather large
178 S numbers of the more complicated bonito-boats (va'aalo).
[501]

100: Koch--481 E-4,5 (1951-1952) 1955 OU9 Tonga OU9
Ganda FK7

/320 cont./

G 248 While in the South Seas Kingdom the old planting cycle was
177 preserved, it experienced considerable change in Buganda through wide-
T spread cotton planting as a result of European influence. This means
245 a saleable crop for the Muganda, similar to the Tongan copra production.
177 While the latter, however, does not demand systematic planting and was
relatively easily incorporated into the old economic system, the
Baganda have been forced, through their cotton raising to give up their
six-month cycle of sowing and harvesting, and their general cultivation
activity is now dependent on the nine-month growth of cotton.--Cotton
harvests for them--like copra harvests for the Tongans--are the most
important means of satisfying their modern material wishes and ful-
filling their obligations toward the government and the large landowners.

G 262 The food of these natives has apparently changed less than that of
177 the Tongans, for here imported European foods have not gained that much
G importance as supplements. The only general innovation connected
[272] with diet seems to be tea-drinking. Peoples here too eat mostly with
G 264 their fingers.

G Bark-cloth production, which was also once generally carried on,
287 177 439 (50)
T [287]
G [462] has here, in contrast to the development in Tonga, very much dropped
off as a result of the import of cotton fabrics. Mats and baskets
G 285 462 are, however, made by the women to a rather large extent.

G Division of labor according to sex in this African country
462 remained basically unchanged--as in Tonga--during the period of
177 European influence. Thus the woman is still responsible for food
[462] planting. But the man who, as a result of the general development of
[177] the country, has been relieved of some of his duties (for example,
G 461 434

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50. In this case, however, it is a coarser type of bark cloth (made of a ficus species) and is men's work.

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15. Building an earth-oven

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16. Making copra: drying halved coconuts

[End Plate 8]

178
369 if imported foods are available and cash is on hand with which to
241 purchase them (Horine 1967, pp. 43-46). In addition, as the possibilities
439 of cash employment in urban areas increases, the population
[262] is less inclined to work their traditional urban gardens.
Rather, they prefer to raise their visible socioeconomic status
through the use of imports. This subsequently reduces further the
amount of foodstuffs produced in the nation.

241 In rural areas of Tonga, major portions of the remaining
178 agricultural sector are changing to a cash orientation. The government
241 requires a substantial portion of a farm holding to produce
439 export products (or at least be planted in such), principally coconuts
245 or bananas. However, many farm plots are totally devoted to
the production of crops for export (Kennedy 1961, p. 61). Major
cash crops include copra and sweet banana, which together account
241 for 80 percent of Tonga's exports. As is the case in urban areas,
178 as the cash income of farmers increases, the incentive for producing
agricultural food staples decreases. This situation will probably
continue as long as market prices for Tongan exports remain high and
the status associated with material products, including imported
foodstuffs, exists.

121 Therefore, one may hypothesize that as Tonga's population
continues to increase, urbanization will increase, agricultural production
of foodstuffs per person will decrease, the dependency being
placed upon food imports will continue to grow, and the nutritional
status of particularly urban populations will probably decline.

423 829 expressed by landowners, as well. However, only 0.3 percent of the sample expressed the opinion that the tenure system should be reorganized. Though this appears to be contradictory, most informants, when pressed on the issue, implied that the land tenure system was based on tradition, and would not change.

511 Considering these features of the system, the following conclusions may be formulated. Although landlessness exists on a large scale throughout Tonga, few landless households suffer critical hardships resulting from land shortage. Most landless individuals consider their income sufficient for household needs. An occasional landless family enjoying remittances from abroad or who derive income from fishing or labor may even achieve an income level above that of the average allotment holder.

121 Land tenure must also be considered in terms of its role in the nation's agricultural economy. Although an in-depth analysis of Tongan agriculture is contained within the following chapter, its relation to land tenure can be considered within the framework of the [457] present section. The major issue which arises is that concerning the basis for the development of cash cropping, which is vital to Tonga's balance of payments.

241 245 245 [439] Cash cropping has been largely confined to the production of bananas and cocnut products. This does not mean that other cash crops are being rejected, owning to land tenure. At the present, several attempts are being made to develop the cultivation of vanilla and citrus as cash crops. Nonetheless, the great majority of export

101: Clark K-4,5 (1974) 1978 OU9 Tonga OU9

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capital earned by cash cropping is the result of banana and coconut product sales.

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Prior to 1965, the slowness with which allotments were registered and the incomplete subdivisions of larger landholdings hindered the expansion of both the banana and coconut crops. Many informants expressed a reluctance to plant their land with such long-term crops as coconuts, until their allotments were registered 245 with the Ministry of Lands, and their tenures secure. Large scale banana production was postponed for the same reasons. Under these circumstances, the cultivation of short-term food crops has been conducted on land often sparsely planted or devoid of coconuts. [654] Since 1965, and the initiation of the Coconut Replanting Scheme, a major effort supported by the government, a marked increase in the area planted in coconut palms has resulted. This, in turn, has 241 encouraged some farmers to cultivate bananas also. Therefore, it 245 appears that the basis for developing cash crop agriculture, within the present land tenure system, is sound. However, expansion will likely fail to meet its potential unless the tenure system is strictly applied and implemented, as stated in Tongan law and theory.

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According to survey respondents, the single major limiting factor to increasing agricultural production is the lack of land. Many farmers expressed a willingness to increase production, if land 241 was made available and secure to them. Assuming this willingness to 423 be reliable, the tenure system limits the average farmer to eight and
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CHAPTER V

AGRICULTURAL PATTERNS

The Traditional System

241 Economically, Tonga is supported primarily by agriculture.
433 Production of primary agricultural products accounts for approxi-
[464] mately 65 percent of the nation's employment and the majority of
(439) all export earnings (96 percent in 1969). In addition to subsis-
[245] tence cropping, bananas and coconut are most frequently raised as
245 cash crops. Copra is currently Tonga's major agricultural export,
439 seconded by bananas. While the export value of bananas was greater
than copra in 1967 and 1968, the occurrence of diseases, which
affect the banana plant, permitted copra to regain its dominance.
245 Copra is expected to remain the major agricultural cash crop in Tonga,
during the near future.

241 Most Tongan men earn their livelihood as farmers, having
434 three basic production activities. Production of subsistence crops
for family consumption is the major concern of the majority of these
men. Additional production activity concerns crops for local sale
and crops for exportation to international markets.

463 Table 13 presents the major labor divisions within the Tongan
162 Kingdom. While only 66.5 percent of the male population is engaged
[241] in agricultural employment, recent surveys indicated that a majority
of the remaining work force are also part-time farmers, producing

134 provide for crop needs.[1] The practice of burning-over land, which
241 follows clearing, represents a significant factor to soil composi-
134 tion. This constant burning severely limits the amount of humus in
the soil and acts to reduce the amount of available nitrogen
241 (Hougland 1974). A further negative effect of burning is evident in
245 cash crop production. Improper timing of the burning process often
results in damage to coconut palms, thereby reducing the number of
nuts produced. Several 'apis were observed where burning had totally
destroyed the immature nuts of producing palms.

241 Following burning, very little ordering of the land is
done. Occasionally, a farmer may rent a small tractor to plow his
land, but usually the cost is prohibitive or the procedure is considered unnecessary. The planting of crops in Tonga involves little more than digging a hole in the soil, planting, and leaving the crop largely untended until maturity. Few farmers effectively weed more than the immediate planting site, and planting often follows no pattern of rows or other orderly arrangement.

[242] Tongans evaluate land fertility by the presence of such wild
vegetation as weeds and grasses, plus previous experience with the
[425] given land. However, land shortages in the more densely populated
areas often limit the choice of planting sites, and even in cases where land is borrowed, usually only the poorer land is lent, and thus secured for planting.

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(124) [1] This information was obtained from an examination of Tongan soil, in conjunction with interviews conducted at the Tongan Government Experimental Farm.

241 244 Yams are the first crop produced during the cultivation cycle, given sufficiently fertile soil. Most farmers interviewed stated that they grew two crops of yams on a given planting site, before proceeding to the next cultivation stage. Interplanted with the yams are a variety of other miscellaneous vegetables, bananas, kape (i.e., giant taro), or plantains. In densely populated areas, such as western Tongatapu, taro is occasionally interplanted also. In regions in which sandy soils prevail, sweet potato instead of yam often starts the planting cycle. This is usually followed by bananas, plantains or cassava.

Following the yam harvest, taro, cassava or sweet potato is planted. While surveys indicate that there is no established pattern or sequence of cropping following the yams, taro was found to be the usual second crop. Most farmers produce two plantings of the second crop prior to the third cultivation stage, which most often involves the production of cassava. Up to six croppings of cassava are produced, although this figure is not the norm. Cassava is occasionally found sparsely planted on fallow land, or growing wild, especially in the densely settled areas of Ha'apai, where the 241 fallow period is much shorter, owing to less available land. An almost endless number of variations of planting and intercropping [244] was reported by individual farmers. However, as the first planting was usually yams, the last planting was usually cassava, for reasons of soil depletion and the ease of cassava production (i.e., the lack [245] of tilling, weeding, and grass control). Only occasionally did the sequence end with bananas, rather than a tuber.

241 Two features of the bush fallow system of particular inter-
est are crop interplanting and crop succession. Interplanting was
found to be practiced by over 90 percent of all landowning farmers
engaged in cultivation. When questioned as to the reasons for this
practice, the most frequent response concerned a desire for increased
production on limited land. However, several additional advantages
were observed. Interplanting reduces farm labor requirements, in
242 terms of weeding, to only minor maintenance activities. Interplant-
241 ing also retards soil erosion, such as on the steep slopes of Vava'u
and the more sandy soils of Ha'apai. In addition, it is believed that
the soil nutrient requirements of interplanted crops are frequently
complimentary, although this was not tested.

The cycle of crop succession in Tonga is primarily based
upon a farmer's knowledge of his land's condition and fertility,
241 plus the fertility requirements of individual crops. Yams are
242 planted first because they require a loose soil, such as is found fol-
244 lowing the clearing process, and a higher soil fertility.

Taro and cassava, the most frequently planted second and third crops, are less demanding on soil fertility. Cassava is particularly notable in this respect. Thus, in the more densely settled portions of Tongatapu and Ha'apai, where the fallowing periods are much shorter and, consequently, soil fertility is lower, cassava is more frequently cultivated.

241 Tuber cultivation, such as for yam, taro and cassava,
[244] represents the principal farming activity in the Kingdom's food pro-
[245] duction. However, several supplementary crops are noteworthy, the

241
245 most important being coconut. The coconut, though representing the
majority of cash-earning export production, is also an important
[262] domestic food source. Coconut flesh and cream are integral parts of
[824] practically every Tongan meal. In addition, products of the coconut
palm are also important to other aspects of Tongan life, from house
construction to production of a shopping basket for marketing.

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249 A second important supplementary agricultural crop is kava.
276 The roots of this plant are dried, pulverized, and mixed with water
to produce what could be called the Tongan national beverage.
Although the taste is somewhat alien to a non-Tongan palate, the
only observed immediate physical effect of this drink was a slight
[142] narcotic quality.[1] Prolonged consumption, however, was noted to
cause a darkening and scaling of the skin, evidenced in some older
Tongans.

241 A third supplementary plant is the papaya, which is only
245 infrequently cultivated for its fruit, and usually grows totally
262 unaided. While foreigners find the papaya to be a welcome addition
to the principally tuber diet of the Tongan, it is, strangely, a
262 native food viewed with low status. Few interviewees admitted to
231 consuming papaya regularly, and frequently described the fruit as
being pig food.

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[1] On several occasions young Tongan men, having consumed a large quantity of the kava drink, or "Tongan beer" as it is commonly referred to, were observed to be thoroughly intoxicated. However, experience indicated that enormous quantities of the drink are necessary to produce anything more serious than a mild headache. From all indications, the intoxicating effect is quite simply psychological, rather than physiological, although all Tongans questioned will attest to the contrary.

241 Cash cropping (to be discussed in greater depth later in this
chapter) in the bush fallow system can be divided into long- and
241 short-term crops. The principal short-term crops include bananas and
● 245 a variety of melons, plus miscellaneous plants. Bananas, as
[244] described above, may be interplanted in the normal planting cycle.
Usually, banana cropping is continued for several years before a
245 plot is returned to fallow. Production from this crop is allocated
[262] to household consumption, or sold in local markets. Surveys encoun-
[438] tered only an occasional farmer producing bananas for the international
[439] export market. Subsequent interviews indicated several limitations
on this type of production, such as plant disease and inadequate
shipping facilities.

The most severe diseases affecting banana production are black leaf streak, bunchy top, and banana scab moth, the most serious being black leaf streak. Decreases in the production of exportable bananas since 1967, equaling 83 percent of the 1967 crop, have been attributed largely to this particular disease. Leaf streak is a fungal disease, characterized by a dark streaked appearance on the plant leaf (Plate 2).^A The disease, by decreasing the total leaf area of the plant, thereby reduces the plant's photosynthetic capacity. The results are smaller fruit, smaller numbers of fruit per bunch, or frequently the complete absence of fruit.

Banana bunchy top is a viral disease, also reducing the photosynthetic area of the plant. It is characterized in the field by the insequential order in which the plant leaves die and the bunched appearance of remaining leaves (Plate 3, p. 74).^B Bunchy top

^A, ^B [Because of poor quality of reproductions in the original, plates have not been marked for a Category--Analyst.]

[TEXT CONTINUED ON PAGE 75]

245 retards the growth and development of the plant, and terminates fruit production.

[136] Banana scab moth, most destructive during its larval stage, may cause damage ranging from simple fruit discoloration to total
[242] destruction (Plate 4, p. 74).[A] DDT, which is frequently used to combat scab moth, has been ineffective in annihilating the pest.

241 The combined effect of these three diseases have reduced
245 internationally marketable banana production by nearly 1.5 million
[433] dollars, representing approximately 30 percent of total agricultural
[439] export production since 1967. Farmers are increasingly hesitant to initiate large scale banana production, unless guaranteed assistance in combating disease and plant destruction.

245 Survey interviews also attributed decreasing banana produc-
505 tion to inadequate shipping facilities. Frequently, harvested bananas are placed on a dock to await the arrival of transport
245 vessels destined for overseas markets. During this time, the fruit
439 becomes over-ripe, falling below export quality. As a consequence,
[435] fruit originally priced up to $1.90 per case may be sold for as little as 40 cents. Because of this potential low cash return,
245 many interviewed farmers stated that large scale banana production was an unwise economic risk.

244 Commercial production of melons, especially watermelons, is also hindered by the inadequate scheduling of transport facilities to
[505] overseas markets. Melons are also produced for Tongan markets, but
[438] frequently earn only low prices, even when out of season.

[435] A[Because of poor quality of original reproductions, plates have not been marked for a Category—Analyst.]

249 Of the miscellaneous crops produced, two are particularly
[241] noteworthy--sugar cane and peanuts. Sugar cane is frequently produced
on the farms of Vava'u, although limited cultivation may be found
[257] throughout the nation. Sugar for domestic consumption is not produced
in the Kingdom, and mature cane is sold in small unprocessed sticks,
much like candy.

244 Peanuts have a great potential for expanded production in Tonga. The presence of a domestic market for peanuts is apparent throughout the Kingdom, and the potential dietary value of this product should be recognized. Employees within the Tongan Ministry of Agriculture blame the lack of extensive peanut production on the laziness of individual farmers. On the other hand, farmers refuse to plant peanuts without guaranteed aid for the necessary machinery and fertilizers.

245 Coconut is the best example of long-term cash cropping.
[439] Products of the palm, principally copra, equal approximately 85
percent of Tonga's total international export. Cultivation of palms
[241] is conducted independently of the food crop planting cycle. If
well cared for, young palms will reach initial production four to six
years after planting, although seven to nine years was frequently
reported in interviews as being the time required prior to production.
The coconut palm will produce for up to 70 years, with 50 to 60 years
[136] being the norm. However, rats and beetle damage claim up to 25 percent of all potential produce.

241 Palms are often not planted in an orderly fashion on a
245 typical 'api, being planted in a seemingly random distribution. An

241 An
245 aerial analysis of Tongatapu, and a subsequent comparison with
171 Western Samoa, revealed a marked difference in planting and cultivation. Portions of Samoa reveal an orderly planting configuration,
241 suggesting more devoted commercial production of coconuts. Tongan
245 farmers, when questioned about the uneven planting, noted that they can produce much larger tuber crop yields if sunlight is not blocked
245 by closely planted palms. However, loosely defined and enforced Tongan laws requiring palm cultivation, plus the desire for a cash income, have motivated an increasing number of Tongans to plant their entire landholding with coconuts.

245 It was noted in such cases that extensive coconut production
241 is accompanied by smaller gardens and less rotation of crops. This
[438] subsequent reduction of tuber food crop yields is compensated by the purchase of foodstuffs in neighboring village or urban areas. In Ha'apai and the more densely settled portions of Tongatapu, an occasional interviewee reported the necessity of planting entire land
[262] holdings in coconuts to insure a cash income. Increasingly, incomes
[439] from cash crops are providing households with diets of imported foodstuffs, replacing those of traditional crops.

The possibility of subsistence crop production in conjunction with coconut planting is largely dismissed by Maude (1970). While coconut yields can be temporarily improved by the occasional clearing of bush for gardens, the burning of the cut vegetation scars the palm and severely reduces production. In addition, once the planting cycle is complete and fallowing begun, vegetation is allowed to grow around the palms unhindered. This growth not only competes

241 for plant nutrients and soil moisture, but also hinders collection
245 of nuts (Maude 1970, p. 60). Similarly, planted food crops also
[435] compete for soil nutrients, and none of the interviewed farmers
reported using significant amounts of fertilizer, owing to rapid
price increases. Only when coconut production is profitable enough
to pay for increased fertilization is interplanting of significant
value.

In addition, when interplanting is practiced, the potential for the reduction of both coconut and subsistence crop yields exists, due to competition for moisture, shading, and damage to the root system of the coconut. Maude concluded that there is, as yet, no satisfactory integration between the bush fallow food cropping system and the coconut plantation (Maude 1970, p. 60). Therefore, as the development of cash cropping continues, through enforcement of palm cultivation laws or simply the farmer's desire to insure a larger cash income, a significant alteration of Tongan agricultural society will emerge.

245 The increased planting of palms since 1965, initiation by the
Coconut Replanting Scheme, has brought about an increase in the cash
241 income of Tongan landholders. However, owing to the incompatibility
262 of bush fallow and plantation cultivation, the landowners' production
of foodstuff for home use is increasingly curtailed. As a result,
the increase in cash income is frequently used entirely in the purchase of food from village or urban markets. The dietary and nutritional implications of this alteration will be discussed in the
following chapters.

● 245 As coconut palm cultivation increases toward the point of monoculture, the potential for destruction of croppings by pests [136] also increases. Two such pests are of particular significance in Tonga--rats and the rhinoceros beetle. Rats, alone, account for a loss of approximately 20 percent of the total coconut crop, annually. Fallow vegetation, which is left growing around planted palms, provides an excellent habitat for rats, and is conducive to rat breeding. Despite efforts by the Ministry of Agriculture to encourage farmers to reduce this cover, Tongan farmers continue to be uncooperative. Damage to young nuts is mot frequent, and occasionally a palm will lose its entire crop to this type of destruction. Plate 5 (p. 81)^A illustrates coconuts which have been destroyed by rats. The most reliable identification of rat damage is a hole gnawed through the coconut husk.

There are two procedures which have been proven to be effective in preventing, or at least curtailing, rat destruction. The removal of cover vegetation effectively discourages large numbers of [414] rats from living in close proximity to the palms. Secondly, fastening metal or plastic strips around the trunk of a palm prevents rats from climbing to the nuts. (This technique is most effective on palm trunks perpendicular to the ground, as opposed to those which lean to any excess.) Agricultural specialists in Tonga reported the use of metal strips to be the most effective method of combating rat damage (Hougland 1974). However, of the farmers interviewed, less [435] than one percent used this technique. Although the strips are cheap (8 to 15 cents apiece) and some varieties are guaranteed to last the

^A[Because of poor quality of original reproduction, plate has not been marked for a Category--Analyst.]

245 life of the palm, the initial cash outlay deters increased usage.
[435] Farmers believe that the initial outlay of 8 to 15 dollars per
hundred palms is excessive, and do not understand the concept of long-
term investment. Agricultural extension workers claim that a more
realistic reason for insufficient use of the strips is laziness of the
Tongan farmer. Only the Mormon plantation and two 'apis were
observed to be using the preventive strips. Plate 6 A illustrates the
simplicity of the procedure.

245 Another pest destructive to coconut production in Tonga is
136 the rhinoceros beetle. This beetle has only recently become a major
threat, and was largely unknown in the islands, until the 1950s and
245 1960s. Plate 7 B illustrates the characteristic angular leaf damage
inflicted on the palm by this insect, which reduces the photosyn-
thetic area of the plant, and subsequently the production poten-
[136] tial of the palm. The most frequently noted method of control
consists of a mound of sawdust into which are placed the eggs or
larva of one of several predator insects, usually mites or click
beetle (Plate 8) C Sawdust is a favorable breeding ground for the
predator insects, as well as for the rhinoceros beetle, which is
attracted to the sawdust pile. Subsequently, the larva of the mite
or click beetle destroys the rhinoceros larva, with up to 100 percent
efficiency. Despite the effectiveness of this technique, it is not
extensively used within the Kingdom. The procedure was observed
being used most frequently in Vava'u, only occasionally in Ha'apai,
and not at all in Tongatapu.

A, B, C [Because of poor quality of original reproductions, plates have not been marked for a Category--Analyst.]

[TEXT CONTINUED ON PAGE 88]

231 Horses are most frequently used for transporting agricultural produce
492 from farm to village markets, either as pack animals or in con-
231 junction with a cart (Plate 9).‸A Despite their obvious usefulness, horses are largely uncared for in the Kingdom, being frequently overworked and then tied in the bush or village with insufficient food and water. As a result, many of the animals evidence gross nutritional deficiencies and, subsequently, operate far below their potential.[1]

Cattle were reported as being owned by 12 percent of the surveyed households. Generally speaking, these households had access to more land than the average, and therefore could allot land for pasture in addition to agricultural cultivation. Cattle are not an integral part of Tongan agriculture, and at present provide only limited quantities of meat and milk. Although past attempts to establish herds on Tongatapu and 'Eua have met with varied success, cattle are not expected to become a significant factor in Tongan
● [249] agriculture. Occasionally, cattle are grazed on cash crop plantations (i.e., coconut), in an attempt to reduce the grass and weed

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[262] [1] The plight of the horse is similar to that of the dog, a frequent food source in Tongan society, in respect to general care. Both have a marked dependency upon man for food and care. In the case of cattle, status insures the well-being of the animal, while pigs, goats, and fowl are able to sustain themselves as efficient scavengers. However, the domestic dog evidences neither characteristic, and is often in a state of starvation, due to his dependency. The same is true of the horse. Therefore, a seemingly contradictory image of livestock is found. Poorly maintained horses, which are essential to agricultural transportation, and dogs, which provide a food source, exist in conjunction with healthy pigs, goats and fowl, the scavengers of Tongan agriculture.

‸A [Due to poor quality of original, plate has not been marked for a Category--Analyst.]

231 cover, which is attractive to rats. However, the initial expense
245 of cattle, plus continued capital outlay for maintenance, substantially reduces the profitability of this scheme.

231 Goats were owned by 27.5 percent of the total survey
[241] sample. Although a potentially valuable source of meat and milk,
roaming goats cause considerable crop damage in Tonga. The goat is
one of three scavengers, competing with pigs and fowl for household
[262] refuse and other edible items. While goats are occasionally used
[431] for meat on special occasions, the pig is considered to be a much
[272] more prestigious food or gift. In addition, because of the low
status ascribed to goats, use of goat's milk is avoided. Thus,
the role of the goat in Tongan agriculture is expected to remain one
of little significance.

Pigs are the most prestigious livestock raised in Tonga, and
[262] were owned by 55 percent of the survey sample. As mentioned previ-
[431] ously, the pig is a meat source used for important social functions
and traditional gifts. Being the most common of Tongan livestock,
the pig plays an indispensable role in the control of garbage and
refuse, plus provision of meat protein. Most households own
several pigs, raising them as a food source or as a means to fulfill
[436] a variety of social obligations. It is not uncommon for taxes,
debts and other financial obligations, especially to the nobility,
[262] to be paid with one or more pigs. Pork is not included in the
average Tongan weekday diet, being consumed primarily during main
Sunday meals or at feasts.

237 TABLE 17.--Approximate Soil Nutrients Per Ton of Manure.

	Nitrogen (N) lb.	Phosphoric Acid ($P_2 O_5$) lb.	Potash (K_2O) lb.
Horse	13.2	5.1	12.1
Cow	11.4	3.1	9.9
Pig	9.9	6.7	9.3
Sheep	115.8	6.7	18.0
Hen	21.0	16.4	10.2

SOURCE: D. Acker, Animal Science and Industry (Englewood Cliffs, New Jersey: Prentice-Hall, 1971.

231 remain most important as an instrument within the Tongan social structure.

Cash Cropping

241 The crops grown primarily for the international export
245 market are coconuts and bananas, although vanilla, melons, fruits and vegetables are also produced in less significant quantities. Survey results, substantiated by personal observations, indicated that most landholdings are at least partially planted with coconut palms, while many 'apis of Ha'apai and Vava'u are totally
241 planted in palms. As the desire or necessity for cash income increases, a greater proportion of the typical 'api will be planted in some type of cash crop.

245 Coconut surpluses, beyond the needs of the family, are usually
439 sold as copra to the Tonga Copra Board. Bananas in surplus are sold

439 [245 [241] to the Tonga Produce Board. The Produce Board also handles the export of vegetables, melons and miscellaneous fruit and agricultural production directed to the international market.

241 Cash cropping, as mentioned previously, consists mainly of two broad categories: long- and short-term production. In addition, each may further be classified as either for domestic or international sale, although short-term croppings (i.e., vegetables, fruit, and melons) are usually domestically sold and long-term (i.e., coconut products and bananas) are international export items.

Cash cropping remains largely in the hands of Tongan officials, with only a few exceptions, including church plantations. The European contribution to this agricultural component is decreasing as leases expire and are not renewed.

439 245 Coconuts, copra, and other coconut products are the major cash crop of the Kingdom, representing as much as 85 percent of total agricultural exports (Table 18).^A 245 434 Survey responses indicated that all landholders rely upon the sale of copra for at least a portion of the household cash income. While statistics from the Department of Agriculture evidenced that the majority of coconut sales originate on Tongatapu, survey data revealed that the proportion of total household income, earned from coconut production, is greatest in Ha'apai. 241 [245 The fact that Ha'apai soils are often not ideally suitable for large scale production of other cash crops, such as bananas, may represent an explanation for this apparent contradiction. Also, in areas of high population density, such as Ha'apai, a smaller proportion of land can be allocated to

A[See Category 439, p. 103--Analyst.]

[TEXT CONTINUED ON PAGE 104]

241 the cultivation of cash crops. Coconut palms, being relatively
[245] independent of the agricultural planting cycle, are a logical choice
for farmers engaged in cash cropping in densely populated areas.

245 In addition to being the major cash crop export, the coconut
palm is also invaluable to the Tongan as a building material and
a source of food and drink. However, until land tenure is secure,
many farmers are reluctant to enter large scale copra production.
241 Interviewed farmers also expressed reluctance to mix the cultivation
245 of food crops and large scale palm growth, because the shade from
palms supposedly reduces the yield from food plants. Frequently,
farmers eliminate all palm growth from small, scattered portions of
their allotments, reserving these areas entirely for food crop production.

245 The frequency with which households collect coconuts and pro-
461 duce copra varies considerably. Survey informants indicated col-
245 lections every week, to once per month. In copra production, the
coconuts are collected and usually transported to a central location,
frequently the area of residency on an allotment. Here the nuts are
split and placed in the sun to partially dry (Plate 11). A Later,
the flesh is scooped out, dried thoroughly in the sun, and bagged
[372] for sale. Occasionally a crude kiln drying shed is used to dry the
flesh, in which the heat is supplied by a fire beneath the shed,
fed by discarded coconut husks and shells (Plate 12). B The produc-
[592] tion of copra usually involves the entire family, with men collect-
[462] ing and splitting the nuts, women extracting the flesh, and small
[85] children guarding the sun-drying copra from dogs and pigs. The

A, B (Due to poor quality of originals, plates have not been marked for a Category--Analyst.)

[TEXT CONTINUED ON PAGE 106]

245 kiln drying shed, introduced in 1938, is replacing the more traditional sun-drying method, being recognized by most Tongan producers as more efficient.

Historically, Tongan copra had the reputation of being [68] poor quality. However, in 1926, government legislation made it a statutory offense for a trader to be in possession of damaged copra. Since the introduction of such laws, the quality of Tongan produce has steadily improved and today ranks among the world's best.

439 647 [655] Coconuts and copra are marketed through the Tongan Copra Board, which is a government monopoly established in 1942. Collection points are located throughout the islands, while the principal grading and storage facilities are in Neiafu, Pangai, and Nuku'alofa. The Tonga Copra Board purchases copra from local producers, and then resells it in the international market. Maude (1965) noted the variance in the international market price (FOB) of copra, as compared to the price paid local producers. After all payment to producers has been made, 36 percent of the FOB price remains with the Copra Board to cover management, handling, export charges and miscellaneous expenses. A survey of local producers throughout the Kingdom indicated their concern and dissatisfaction with the government's arrangement. Some farmers expressed the opinion that internal corruption caused the cash variance. It is clear that while the average Tongan farmer does not understand the management and market economy of copra, a growing resentment of the pricing policy of the Copra Board is evident.

439 Bananas are Tonga's second most important cash crop for the
245 international market, although exports and capital earned by this
crop have decreased significantly since 1967 (Table 18, p. 103, A
and Table 19, below). Tongatapu is the principal producer, with
439 Vava'u being second. Banana exports represented 45 percent of the
value of total exports in 1967, but by 1973, equaled less than 15
percent. While this percentage has continued to decline, the
245 market price for banana produce has generally risen. Owing to this
439 rise in price, many farmers expressed a willingness to produce
bananas, providing governmental assistance was received in combating
245 crop disease. (As mentioned previously, the principal reason for

439 TABLE 19.--Tongan Banana Exports and Their FOB Values.

435

Export Year	Total Quantity of Export (thousands of lbs.)	Total Revenue Earned by Banana Exports
1965	22,708 lb. at 4.1¢ a lb.	$ 941,222
1966	31,883 lb. at 4.2¢ a lb.	1,337,554
1967	43,949 lb. at 4.1¢ a lb.	1,794,000
1968	37,674 lb. at 4.6¢ a lb.	1,738,679
1969	15,147 lb. at 4.5¢ a lb.	683,440
1970	10,268 lb. at 4.5¢ a lb.	465,950
1971	7,706 lb. at 4.8¢ a lb.	368,970
1972	6,743 lb. at 4.8¢ a lb.	327,914
1973	6,272 lb. at 4.8¢ a lb.	302,400

SOURCE: "Banana Exports Have Declined Sharply," Tonga Chronicle, August 8, 1974.

A [See Category 439--Analyst.]

245 decreasing production of bananas is the spread of black leaf
streak, bunchy top and scab moth.)

439 Marketing of banana produce, through the Tonga Produce
[647] Board, is often difficult because of improper scheduling of shipping facilities and the subsequent sale of under or overripe fruit.
[435] In one example, 9,000 cases of produce became overripe while in
wharfage awaiting shipment, resulting in the fruit being sold for
40 cents per case (Report of the Minister of Agriculture 1973,
p. 5). The bulk of banana produce is shipped to New Zealand,
although the shipping difficulties and quality control remain
245 obstacles to full entry into this market. These same problems
439 with marketing, shipping and quality have been effective in removing
[654] many Tongan farmers from banana production. At present, the Produce Board reports that export levels are so low that levies are
not sufficient to provide a comprehensive service to growers in
such areas as disease control ("Banana Exports . . ." 1974, p. 5).

439 In addition to the exportation of bananas, coconut, and
438 miscellaneous melons, fruits and vegetables to international
markets, small quantities of produce are also traded among the
islands, the most important of these transfers being from 'Eua to
Nuku'alofa on Tongatapu, and from Nuku'alofa to Pangai and Neiafu.
This movement involves not only domestic produce, but also food
imports such as tinned meats, sugar, flour and a wide range of
foodstuffs sold through the local stores (fale koloa).

443 Large quantities of produce are also marketed domestically.
[438] Although some produce is sold in several smaller settlements, the
[366]

434 (This concept, which is becoming more notable in all segments of
178 Tongan population, is analyzed within the following chapters.)

241 In summary, while many aspects of Tongan agriculture have
178 remained basically unchanged through history, there have been
several significant alterations with respect to population growth,
178 land distribution and cropping practices. The most significant of
434 these changes has been the development of cash cropping and the
[241] subsequent rise in purchasing power of the average Tongan farmer.
[439] An indication of these alterations is the increased incidence of
[262] material items within the household, plus reliance upon imported food
products, such as tinned meat, fish, bread and sugar.

245 The continually good market for copra and coconut products
241 has resulted in many 'apis being planted almost entirely with palms,
[178] and less production of traditional foodstuffs. In addition, in
densely populated areas where food crops are interplanted with palms,
the competition for sunlight, soil nutrients, and moisture insures
significantly lower yields from food plants.

178 Low production yields associated with decreases in soil
241 fertility are frequently the result of the shift to a more continuous
exploitative cropping system. This change is stimulated by the
178 Tongan farmer's desire for increased cash income, and by increasing
241 population pressure on land available for cultivation. This population
161 pressure is intensified by the migration of individuals to
Tongatapu from the other island groups, especially Ha'apai. The
Tongan situation is becoming increasingly intensive, with often a
crop/fallow period ratio of one to one, and a supported population

ing the Multiplication Table they accompanied themselves by 872
clapping their hands in time to the words, throwing the arms from
side to side, all calling out at the same time at the top of their
voices, and seeming to enjoy the whole affair amazingly. An old [634]
chief of considerable influence, named Shadrack, sat with the [565]
missionaries at the head of the school, and whenever the crowd
outside talked too loud he commanded silence.

After this examination was over we visited another school, for 874
the instruction of native teachers, which consisted of about twenty (123)
persons in all, principally chiefs and their wives. When we
entered the school-room they were all standing up round the sides [565]
of the apartment, reading aloud. They were taught English,
arithmetic, geography, writing, &c. After the reading and ciphering
exercises were over, they sat down in two rows before a frame
containing a set of large maps. These were drawn down, one
after another, the natives repeating the names of the places, with
particulars respecting them, as they were severally touched by the
missionary. Captain Keppel then desired them to point out 874
various places which he named. Spain, being the first, was immediately
pointed out by a chief, Shadrack Moomie, Judge of the 123
Island and a son of the late king. The end of the rod was then [634]
shifted slightly over, so as to rest upon Portugal, which Shadrack
immediately named; and being asked to point out some islands
in the Mediterranean which were mentioned, he did so readily.
Being desired to show the track which should be taken by the
Meander, for England, he at once traced it correctly. The rest 874
of the pupils appeared equally intelligent. Several of the wives
of these chiefs were present, and were treated by the men with [593]
marked attention, being seated in the foremost places. The
missionaries call this "the native training institution," or school
for educating native teachers. At the time of our visit there
were twenty-four natives under this kind of instruction—eight
being from the island of Vavau, six from Haabai, and ten belonging
to Tongatabu. Besides these there are twelve female students,
eight of whom are wives of the native teachers: there was
also a chief from Feejee.

The two school-rooms, together with the houses of the native 874
teachers, are built within a fence enclosing about 20 acres of 351
ground, which was given for the purpose by King George. It is
cultivated as a garden by the teachers residing upon it; and a [346]
broad walk, bordered with pine-apple plants and bananas, runs [245]
along its whole length, and on each side are the cottages of the
teachers, with neatly kept paths leading to them from the main
walk.

After attending the examinations, Mr. Thompson, the chaplain of 123
the Meander, and myself, went upon an exploring stroll round the